



ETSI MONTES, FORESTAL Y DEL MEDIO NATURAL

UNIVERSIDAD POLITÉCNICA DE MADRID

SUSTAINABLE DEVELOPMENT IN NORTH BOHUSLÄN (SWEDEN): AN ANALYSIS IN THREE SCALES

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ANTECEDENTES

Este trabajo es la continuación de un proyecto grupal de 18 créditos ECTS realizado durante mi estancia Erasmus en la Universidad de Ciencias Agronómicas (Swedish University of Agricultural Sciences) en Uppsala, Suecia, dentro de un programa del máster en Arquitectura del Paisaje llamado “Landscape Project Studio- Advanced Course”.

El proyecto se estructuró en tres escalas diferentes con el fin de entender la fuerte conexión entre las mismas y estudiar los problemas comenzando por una escala general y moviéndonos hacia escalas más detalladas. Las dos primeras escalas del trabajo fueron desarrolladas durante el periodo Erasmus, en un equipo multidisciplinar formado por cuatro personas:

Malin Windblad
Maria Bergvall
Jannica Lindén
Patricia Rull López

La última escala, donde figuran propuestas individuales para el desarrollo de una determinada área, fue planteada desde la perspectiva requerida por el programa de Arquitectura del Paisaje. Tras la estancia en el extranjero fue mi propuesta individual la que decidí ampliar desde un punto de vista más técnico y detallado.

RESUMEN DEL PROYECTO

El propósito inicial de este proyecto es el estudio de las afecciones producidas en los asentamientos y en el paisaje por la carretera E6 en su recorrido desde el municipio de Uddevalla, al suroeste de Suecia, hasta la frontera con Noruega. El objetivo es sugerir un escenario mejorado y una visión de desarrollo sostenible para la región.

El proyecto se estructuró en tres escalas diferentes con el fin de entender la fuerte conexión entre las mismas y estudiar los problemas comenzando por una escala general y moviéndonos hacia escalas más detalladas, siguiendo la estructura siguiente:

PRIMERA ESCALA: REGIONAL

En esta primera etapa, nos centramos en la escala regional, recogiendo información para conseguir un entendimiento general de la región. Comenzamos con un estudio de los desafíos globales que enfrenta nuestra área y cómo los municipios pretenden enfrentar estos problemas en sus planes regionales.

Por otro lado, realizamos un análisis de la zona y de los tipos de paisaje encontrados por medio de un inventario y Evaluación del Carácter del Paisaje. Además, analizamos los diversos aspectos de la región por medio del método PEBOSCA, el cual es un marco dentro del Programa Hábitat de las Naciones Unidas que pretende proveer un análisis de los recursos (físicos, económicos, biológicos, organizacionales, sociales, culturales y estéticos) de una determinada zona (Berg, 2010); y el método DAFO (siglas en inglés: SWOT) en el cual estudiamos las debilidades, amenazas, fuerzas y oportunidades de la región.

Finalmente, identificamos los problemas o desafíos más significantes para la región proponiendo estrategias generales para los mismos, a saber: ampliar la diversidad de servicios durante todo el año, mejorar la conectividad extendiendo el transporte público y carriles para bicicletas, mejorar la calidad del agua y disminuir el efecto barrera de la carretera E6. Así mismo, definimos nuestra visión en la escala regional: <<Fortalecer la “Región Funcional” para soportar posibles cambios futuros. Para conseguirlo necesitamos mejorar las cualidades locales de cada municipio y fortalecer la cooperación regional. Las cualidades naturales son esenciales para la mejora del reconocimiento local>>.

SEGUNDA ESCALA: INTERMEDIA

En esta segunda etapa nos centramos en Hogdalsnäset, un área más pequeña la cual consideramos más afectada, compleja y con una gran influencia en la región. Lo que distingue a Hogdalsnäset de las otras zonas consideradas es la falta de una estructura urbana y su proximidad a la frontera con Noruega.

En este caso, realizamos una más detallada Evaluación del Carácter del Paisaje así como análisis PEBOSCA y DAFO y un inventario más preciso de las diferentes capas del paisaje. Finalmente, sugerimos una visión alternativa para un desarrollo sostenible en el área seleccionada: <<Desarrollar Hogdalsnäset como área rural con una fuerte identidad aprovechando la situación actual al contar con el mayor centro comercial de Suecia y el paisaje rural circundante>>. Además, definimos nuestras estrategias ya mencionadas en la primera escala, y la claves de diseño que pretendemos desarrollar en las propuestas individuales de la tercera y última escala.

TERCERA ESCALA: LOCAL

En esta tercera etapa, elegimos trabajar con Nordby, donde encontramos la mayoría de los problemas así como muchas oportunidades. Nordby es la mayor atracción de Hogdalsnäset, con cerca de 7 millones de visitantes al

año, lo cual le aporta un gran potencial de desarrollo que podría ayudar a la mejora de Hogdalsnäset y de la región en general.

En primer lugar describimos las diferentes alternativas de desarrollo futuro en Nordby planteadas para finalmente presentar nuestro plan alternativo, incluyendo un escenario de desarrollo a lo largo del tiempo:

Escenario de 1 a 5 años:

- o Reverdecimiento de las zonas de estacionamiento con el fin de iniciar la adecuación ecológica del centro comercial.
- o Tratamiento de aguas para prevenir inundaciones y mejorar la calidad visual y ecológica de los cursos de agua.
- o Mejora del transporte público con el fin de reducir la dependencia en los coches.
- o Creación de una nueva vía de acceso para reducir la presión en la vía principal.

Escenario de 5 a 30 años:

- o Creación de un Centro de Visitantes con el objetivo de servir como centro de educación e información para promover la importancia e identidad local.
- o Implementación de infraestructuras verdes, con el fin de reducir la magnitud de zonas pavimentadas y facilitar diferentes usos del lugar ante un destino imprevisible para el mismo.
- o Continuar con la mejora del transporte público.

Escenario a partir de 30 años:

- o Nordby como un eje resiliente y sostenible, capaz de sobrellevar posibles cambios en la economía mundial, cambio climático y cambio en el uso del suelo. La naturaleza estará incorporada en las zonas pavimentadas las cuales serán funcionales y dinámicas.

Finalmente, presentamos las propuestas individuales en una escala aún más precisa dentro del contexto de nuestro estudio y basándonos en las claves de diseño y estrategias para la región:

- Propuesta 1: Parque del Humedal, por Patricia Rull.

Esta propuesta se divide a su vez en dos secciones, correspondientes a un enfoque general y un enfoque detallado respectivamente. En la primera sección, se introduce la propuesta del Parque del Humedal así como las ideas que motivan su construcción. Un borrador basado en una idea general muestra a su vez las diferentes consideraciones de diseño. En la segunda sección se abordan los problemas detectados dentro de un enfoque detallado, realizando las modificaciones precisas con respecto al enfoque general. Los problemas tratados son las inundaciones, para lo cual se plantea la creación de un Estanque de Detención; y la adecuación paisajística con fines recreativos y educacionales, así como brevemente su implicación en la calidad del agua, para lo cual se desarrolla la idea de creación del Parque del Humedal.

- Propuesta 2: Reverdecimiento de Nordby, por Malin Windblad.
- Propuesta 3: Nordby, más que un centro comercial, por Jannica Lindén.
- Propuesta 4: Centro de Visitantes, por Maria Bergvall.

ASSIGNMENT INTRODUCTION

The assignment is to look into the area along the E6 from Uddevalla to Strömstad and the Norweigan border and investigate how the road affects the surrounding landscape and settlements. Our task is to suggest an improved scenario and a sustainable vision for the development of the region.

We will mainly work in a teams of four people and will work in three different scales, keeping the following structure:

STEP 1: REGIONAL SCALE

In this first stage we focus on the regional scale, starting with the global challenges, layers in the landscape and an analysis of the different landscape types through a Landscape Character Assessment (LCA). We are also doing an overview analysis of the diverse aspects of the region by PEBOSCA and SWOT. Finally, we identify the most significant challenges for the region and propose general solutions to them.

STEP 2: INTERMEDIATE SCALE

In the second stage we look further into a smaller section of the highway and the surrounding landscape, which we consider to be most affected or very interesting. A more detailed LCA analysis and SWOT/PEBOSCA is done as well as a more detailed inventory of the different layers in the landscape. As a team, we suggest an alternative vision for a sustainable development for our chosen area by defining our strategies and design keys.

STEP 3: FINE SCALE

In this final stage each member of the team provides a fine scale design proposal within the context of our case study, based on the design keys and strategies for the region.

By working in different scales we are able to view the challenges from different scaled angles. By starting at the big scale and move towards the smaller scales and even more, moving up and down in scales, helps us propose resilient solutions for the region as a whole. It is important to se the strong connection between the scales to get the big picture of every project.

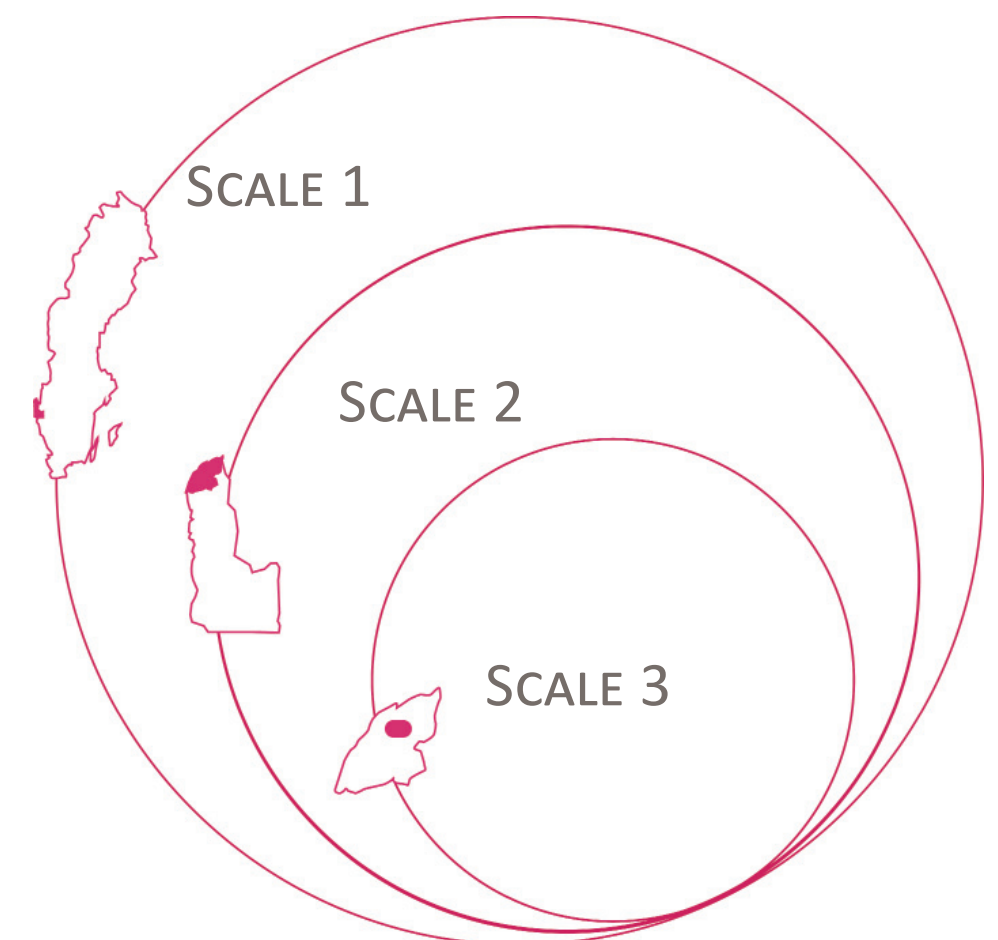


TABLE OF CONTENTS

INTRODUCTION

Team introduction.....	1
Document structure and reading instructions.....	2
Introduction to The e6.....	3

FIRST SCALE

INVENTORY	7
Global challenges in Bohuslän.....	9
Regional guidelines.....	10
ANALYSIS	17
Physical.....	24
Economical.....	25
Biological.....	26
Organizational.....	27
Social.....	28
Cultural.....	29
Aesthetic.....	30
SYNTHESIS OF INVENTORY AND ANALYSIS	31
PROPOSAL	35
Our vision.....	37
Strategies.....	37
Challenge clusters within Strömstad municipality.....	40

SECOND SCALE

INVENTORY	43
Land use.....	45
Nature.....	47
Connectivity.....	52
History and cultural landscape.....	54
Social Aspects.....	56
Corelation between conclusions.....	58
ANALYSIS	59
Strengths.....	71
Weaknesses.....	72
Opportunities.....	73
Threats.....	74
SYNTHESIS OF INVENTORY AND ANALYSIS	75
PROPOSAL	81
Our vision.....	83
Strategies.....	83
DETERMINATION OF THIRD SCALE	89

THIRD SCALE

ANALYSIS	94
Challenges in Nordby.....	95
Important improvments.....	95
ALTERNATIVES FOR DEVELOPMENT	96
Development alternatives for Nordby.....	97
Masterplan Our alternative.....	98
INDIVIDUAL DESIGN PROPOSALS	100
Wetland park	101
Part 1- General Approach.....	103
Part 2- Detailed Approach.....	111
Nordby PARKing.....	124
Nordby - more than a mall.....	131
Visitor centre.....	137
REFERENCES	145

TEAM INTRODUCTION

Our team is build up and runned by three landscape architects and one environmental engineer. We have different previous experiences and are in different stages of our studies.

We are inspired by changes and the correlation between different scaled structures in the landscape. In this project we are mainly inspired by the beauty of the landscape and the relation between economic activities and the identity of a place.

The most interesting with this assignment is how our professions can handle a rural area and its resources in relation to global economic and climate forces. We are in particularly interested in the phenomena of external shopping malls and how a future sustainable development could look like. We know that external commerce appears in many countries. The question we would like to highlight with this project is how we can improve, transform and develop external shopping malls.

What we also find very interesting with this assignment is the challenge of working in different scales and view problems from different scaled angles. Another interesting factor is the multiple outcomes that each team will present which will be the base of a rewarding discussion.

Every team work is offering a learning experience and this is not an exception. We have coordinated our work, shared opinions, cooperated, discussed and divided tasks between us, all for the same purpose; to reach the best possible solution.

Jannica Lindén

A landscape architect masters student from Roslagen. She is a creative and always positive person that inspires the team. She is specifically interested in finding sustainable solutions for both people and their environment.

Malin Winblad

A landscape architect masters student from Bollnäs. She's the technical mastermind in the group. What interest her the most is problem solving design and small scale interventions.

Patricia Rull




A thoughtful Spanish environmental engeenering student. She contributes with an important and different view and a good sense of humour. Patricia has an interest in ecological restoration issues with a focus on water bodies.

Maria Bergvall

A landscape architect masters student from Ekerö. She is a very driven person that structure and motivate the team. She is personally interested in interventions in developing countries and temporary landscape architecture.



DOCUMENT STRUCTURE AND READING INSTRUCTIONS

The document is divided in three main parts: first scale , second scale  and third scale .

The first and the second scale is divided in to 4 main chapters:

INVENTORY REGIONAL PLANNING FUTURE CHALLENGES ASPECTS??	ANALYSIS LCA - CHARACTER TYPES PEBOSCA AND SWOT	SYNTHESIS OF INVENTORY AND ANALYSIS CHALLENGES ALTERNATIVE SOLUTIONS	PROPOSAL OUR VISION ALTERNATIVE SOLUTIONS
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Under these chapters the different parts are divided with white pages describing the method and our approach for the specific part. See example below:

LCA - CHARACTER TYPES

Method
We have used the method LCA Landscape Character Assessment as a tool to describe the landscape. It helps us identify the features that gives a locality its 'sense of place'. The LCA was founded in England about twenty years ago. LCA offers different tools that can be combined to meet the purpose of the study (Landscape Character Assessment: Guidance for England and Scotland, The Countryside Agency and Scottish Natural Heritage, 2002).

Our approach
On this large scale analysis our main source has been maps from GIS and the municipalities. The time frame within the course restricted us in doing site visits on the larger scale. Therefor the LCA lacks comments on the sensory scale. This analysis describes different character types and omits the next stage with defining character areas. The LCA is very general.... Whats the differnec between types-areas ? on this cale better with types?

To make it easier to orientate in the document we show where in the document you are in the corner of every page. See example below:

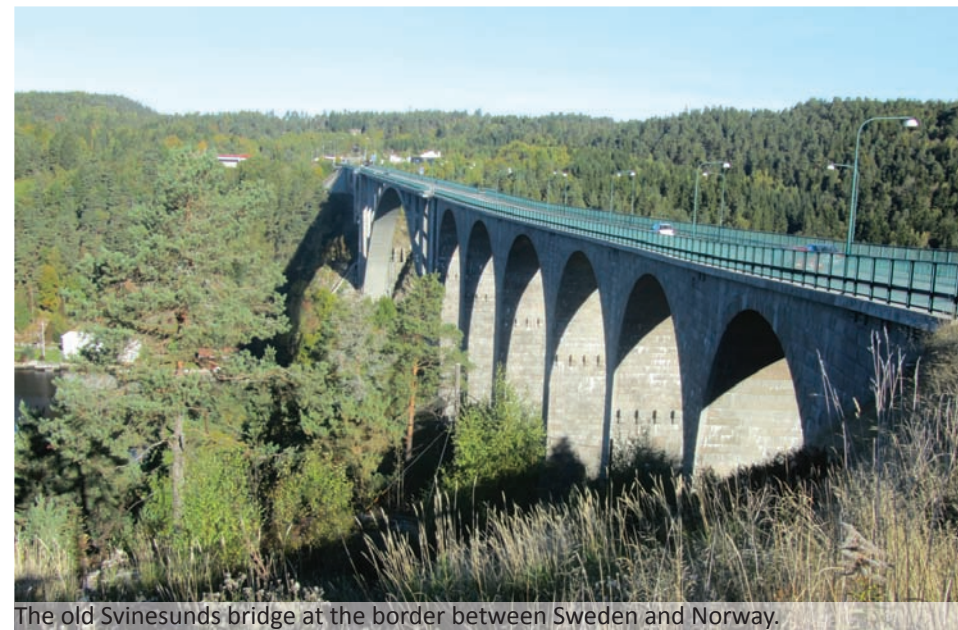
INVENTORY	CHAPTER
	SCALE
2	PAGE NUMBER

CONCLUSIONS

To gather our conclusions we have used grey boxes like this one. They work to summarize and analyse the different parts of the project to gather the most important information for our proposal.



E6 connecting Sweden with Norway, Finland and Russia



The old Svinesunds bridge at the border between Sweden and Norway.



The new stretch by Tanumshede cuts trough the landscape.

INTRODUCTION TO THE E6

CONNECTION TO NORWAY

The E6 is the road from Sweden to Norway. It starts in Trelleborg and goes to Kirkenses in the north of Norway from where it also connects to Finland and Russia. The E6 has an important role and connect Norway to Europe. The total length of the E6 is 3120km of which 2630km goes through Norway where half the road is situated north of the arctic circle (Wikipedia, 2013).

In Norway most of the road has two lanes but the stretch from Svinesund north of Strömstad, to Norway has highway standard with four or more lanes. This might be explained by the amount of freight traffic that goes from Oslo to the Harbour in Gothenburg (Wikipedia, 2013).

The Svinesund bridge with the related highway portions on each side of the fjord is the second place other than the Öresund bridge that has a border toll station in Sweden (Wikipedia, 2013)

200 KM IN 50 YEARS

The expansion of E6 through Bohuslän is a lengthy process and the road has been built out in segments from south to north. E6 through Bohuslän is a leg in the nordic triangle that connects Oslo, Gothenburg and the Öresunds region. The road has a lot of heavy traffic with an increasing number of freight traffic. The west coast in itself is a big tourist attraction and the expansion of the E6 was crucial for the summer traffic flow. The new high standard on the road has decreased amount of car accidents (Trafikverket, 2010).

The landscape the road goes through contains a lot of bare rock and the rift valley landscape is heavily undulated. The form of the landscape has made the work expensive and complicated with a lot of extensive foundation work and blasting. The road crosses many mountains and valleys which has lead to a lot of large bridge constructions. Today the E6 is called the road of the beautiful bridges (Trafikverket, 2010). This is affecting the surrounding landscape where habitats can change, get lost or fragmented. Also the image of the landscape has changed where the road is cutting through.

Before 1958 the road was called “Rikstväan” (National road number two). The first part to be converted to highway standard was the stretch from Gothenburg to Kungsälv that was finished in 1956. The last part to be converted to highway standard is the stretch between Pålén and Tanumshede. This has been the most difficult part due to its location trough a World Heritage Site, it is expected to be finished in 2015 (Trafikverket, 2010).

Apart from strengthening the connectivity in the region the E6 road is also bringing a barrier to the landscape offering only a few passages over it for humans and animals. The on and off ramps are few compared to a road without highway standard. Therefor the E6 can decrease the connectivity on a more local level where people living close to the road might have to drive far to get to the closest on and off ramp. The E6 is also very focused on cars and are mostly located outside the city cores which lead to car dependent development where external commerce often is established along the road.

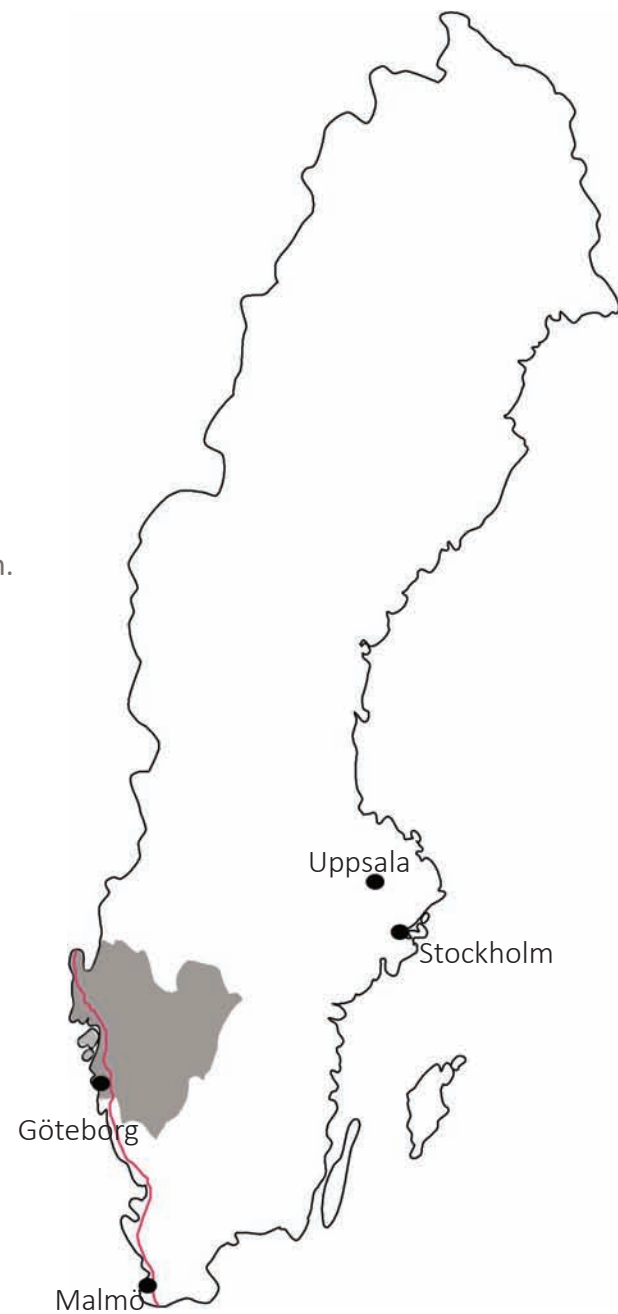
E6	Göteborg- 1958	Genom 1968	Kungsälv- 1972	Kode- 1974	Stora Höga- 1991	Genom 1994	Ljungkile- 1995	Lerbo- 2000	Torp- 2004	Kallsås - 2005	Smäröd- 2008	Saltkällan- 2008	Häby- 2000	Rabbalshede- 2010	Pålén- 2015	Tanumshede- 2011	Knäm- 2012	Lugnet- 2010	Skee- 2012	Ejgst- 2008-09	Hogdal- 2003	Nordby- 2005	
	Kungsälv	Kungsälv	Kode	Stora Höga	Ljungkile	Ljungkile	Lerbo	Torp	Kallsås	Smäröd	Saltkällan	Häby	Rabbalshede	Pålén	Tanumshede	Knäm	Lugnet	Skee	Ejgst	Hogdal	Nordby	Svinesund	

LOCATION OF PROJECT

Bohuslän is the westernmost region of Sweden, located in Västra Götaland County in the southwestern part of Sweden. In the west, Bohuslän is adjacent to Skagerrak and Kattegat facing the North Sea. In the southeast Bohuslän is framed by the Göta Älv river and in north Idefjorden and Norway (Wikipedia 2013).

Bohuslän has around 270.000 inhabitants and is influenced by the seasonal flow of people as it is known as a summer-holiday destination. It is known for its fishing, saltwater swimming and bare rocks but also for its 20.000 registered archaeological sites. Many well-preserved rock carvings can be found in Bohuslän craved into granite 2500 - 3000 years ago (Barnsemester.se 2013). In Vitlycke there is a World Heritage Site showing the old landscape and many rock carvings.

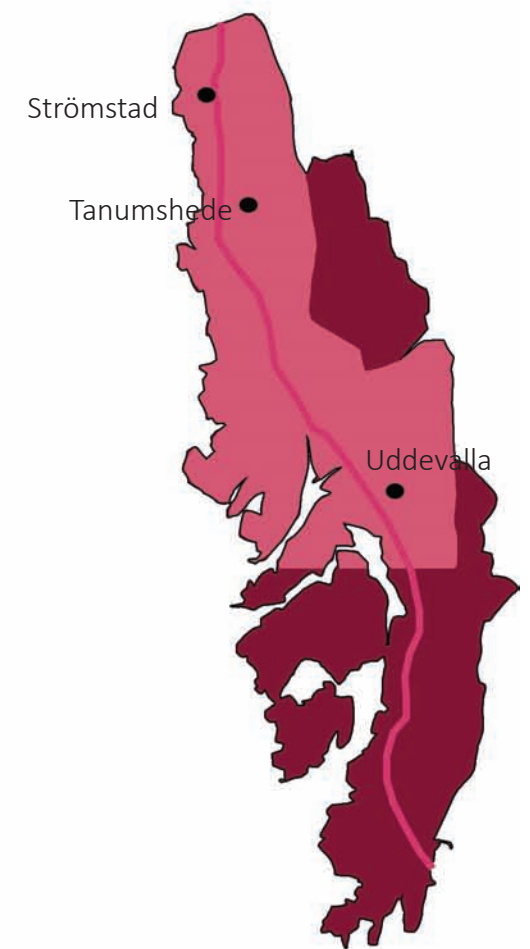
Bohuslän includes 3.000 islands and has a very dramatic landscape, very special in Sweden, differing from the usual mid-Sweden picture. It is relatively mountainous, especially at the eastern parts. Nevertheless, its highest peak Björnerödspiggen is only 222 meters above sea level. Our study area covers most of the northern part of Bohuslän, essentially from Uddevalla up to the Norwegian border, see maps to the right.



Västra Götaland in Sweden



Bohuslän in Västra Götaland



Our region in Bohuslän

FIRST SCALE

E6 AND SURROUNDINGS

In this first scale we have gathered information to get a general understanding of the region. The information and analysis in this scale is done with a holistic view where we have looked at the region as a whole rather than on a detailed scale which we will do more thoroughly in the second scale.

This first part of the work begins with a description of the municipalities goals and the future global challenges that the region is facing. We shortly describe the layers of the landscape and the character of the landscape is described in a general Landscape Character Assessment (LCA). As an analysis we have done a SWOT analysis on the PEBOSCA resources (Which are described in the beginning of PEBOSCA/SWOT chapter). The first scale ends with a synthesis where we have pointed out the challenges we have found on a map and we describe our vision for the region as a whole.





INVENTORY

REGIONAL PLANNING

FUTURE CHALLENGES

LAYERS IN THE LANDSCAPE

GLOBAL CHALLENGES AND REGIONAL PLANS IN BOHUSLÄN

Method

In global challenges we have gathered information to get an understanding of how global challenges will affect our area and how the municipalities suggest to tackle this challenges. In the next part, Regional Plans we have made a general description of the plans of the municipalities and at the end we have analysed the tendencies in the region in relation to the global challenges.

Our approach

This helps us to understand the existing tendencies and plans for the area and will serve as a base when we make our own analyses.

GLOBAL CHALLENGES IN BOHUSLÄN

CLIMATE CHANGE

The world is facing a dramatic ongoing climate change due to increased greenhouse gas emissions. North of Bohuslän is facing a wet and warmer future that will affect the society in many levels. In the report from Länstyrelsens about the changing climate of the region they describe how the increased temperature will result in shorter winters and longer growing seasons. That could be a positive development that would support higher production and development of new crops, but also more invasive plants and pests. The future heavy rainfalls will result in higher flows in the waterways and increase the risk of flooding and landslides. This will affect the economy in the region with higher costs for reparation and maintenance of roads and restoration of flooded farmland. There is also a risk for a disturbance of important functions in the region such as exclusion of electricity and clean water distribution. Even long term affecting consequences could be seen such as weathering of cultural remnants and increased nature values. The future sea level rise is set to be 65-80 cm within a century. This will leave many coastal settlements permanently under water. The high tide water position will increase and certain areas are at risk of occasionally flooding (Länstyrelsen Västra Götalands län 2012).

URBANISATION AND

Roland Lexén, head of "Arena för tillväxt", discussed the tendency of urbanisation in west Sweden on a seminar organised by Tillväxt Bohuslän. He pointed at how half of the municipalities in Sweden loose inhabitants to larger cities, specifically to those with universities. Lexén meant that we are facing an increasing regional competition and cooperation in a new geographic economy. The challenge of the competition of residents and the shrinking working population are shared by the society, industries,

municipalities and regions (Tillväxt Bohuslän 2012). Boverket describes in the report *Sverige 2025* how attractive areas with their own guidance niche growth independent of the closeness to a larger city. For instance the border trade is important for the growth of our areas close to Norway. Although Boverket describes how the long-term growth capacity in our border zones are hard to assess. According to Boverket the attractiveness of interim housing in North Bohuslän has increased the market prices which resulted in hard times for the permanent residents to find housing. Areas like North Bohuslän with a large population part-time of the year but few people actually registered in the region have difficulties funding the needed public services. Boverket means that the liquidation of rural towns is inevitable and that the challenge today is to handle the natural liquidation in a sustainable and planned way (Boverket 2012).

CENTRALISATION OF MARKETS

In the futuristic report *Sverige 2025* Boverket describes what need to be done in order to achieve a sustainable long-term approach to the sparsely populated rural areas. The most important necessity is to collaborate within the region with the aim to provide supplementary attractions and services that all together strengthen the region. This will provide a functional region where the unique areas contribute to the region as a whole. Good internet and public transport communication will provide a base for people working at home and will be another way to attract people to the rural regions. Boverket also points at the importance of a regional planning that has a long-term approach to changes in land use. But also a planning that take in high consideration the natural, cultural and social values in the landscape when planning new development. Finally Boverket describes how the government need to redistribute tax revenues (Boverket 2012).

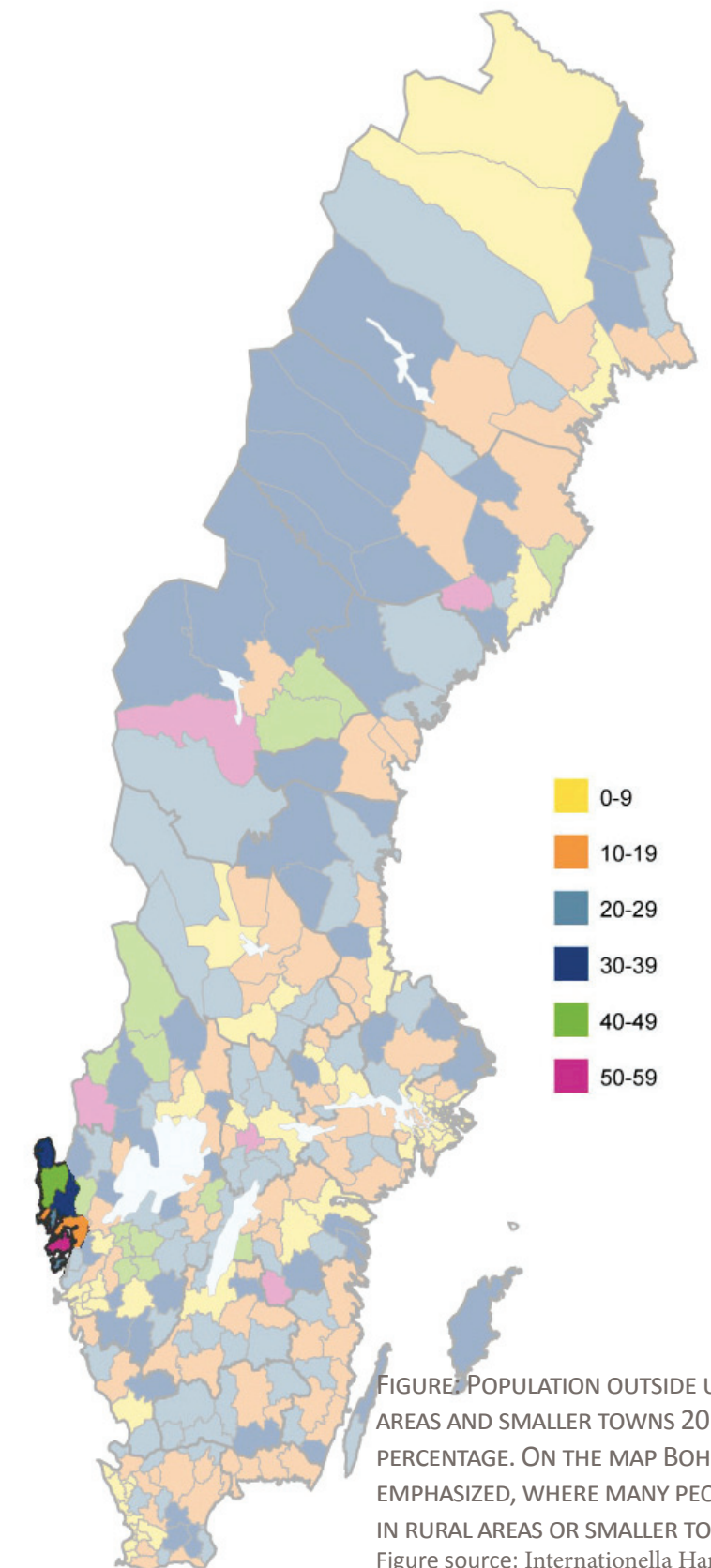
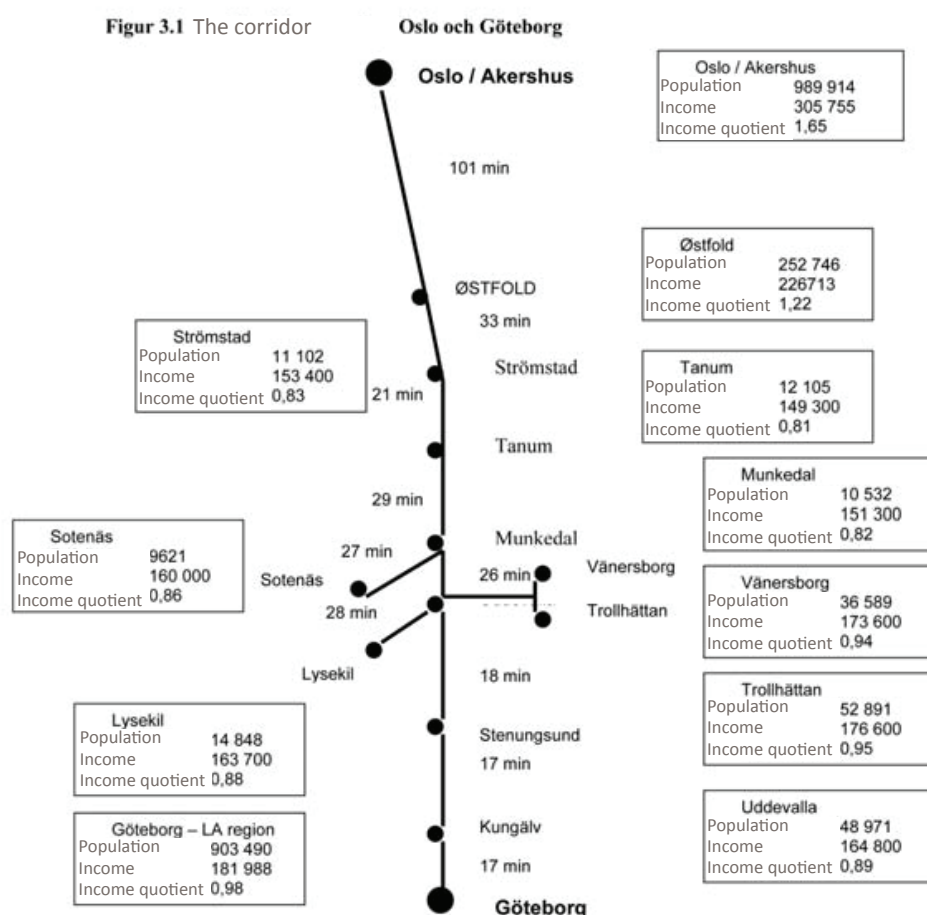


FIGURE. POPULATION OUTSIDE URBAN AREAS AND SMALLER TOWNS 2010, PERCENTAGE. ON THE MAP BOHUSLÄN IS EMPHASIZED, WHERE MANY PEOPLE LIVE IN RURAL AREAS OR SMALLER TOWNS. Figure source: Internationella Handelshögskolan i Jönköping

REGIONAL GUIDELINES



4 MUNICIPALITIES AND THEIR GUIDELINES

Uddevalla's main goal is to strengthen the infrastructure, the small businesses and the cultural values. Tourism and harbour business are two important factors for the requested economic growth in Uddevalla. Other essential goals for development is the ecological and social improvements (Uddevalla kommun 2010).

In **Munkedal** the focus lies on the development of a sustainable and environmental friendly municipality. They want to create a variety of housing with good connections to nature and recreational areas. They also emphasize the importance of good communications, infrastructure and services (Munkedal kommun 2010).

The comprehensive plan in **Tanum** describes how Tanum is a municipality characterized by small-scale entrepreneurship and the closeness to nature and water. With the strong connection to history where the rock carvings and cultural heritage is important the municipality wish to develop in a sustainable way that strengthens the identity of Tanum (Tanums kommun 2002).

Strömstad municipality uses three key words for future development. The first one is The Coastal Town, which highlights the importance of coastal connections and land conservation. The Environment is the second key word, meaning that future development should sustain a diverse landscape. The last key word is Experience where they want the development to aim towards places with high quality experiences, for both locals and visitors (Strömstad kommun 2002).

GENERAL TENDENCIES IN THE REGION

Today most of the plans for infrastructure development in the region is situated along and around the E6 and the local railway Bohusbanan. E6 and the regions strong focus on economical growth give rise to new plans for an expansion of existing external commerce and a development of new commercial areas with car dependence to follow.

Other tendencies in the region is the strong focus on tourism and development of settlements along the coast and a densification of the larger cities (Uddevalla, Munkedal and Strömstad). In all municipalities the heterogeneous landscape and biological values on land and in the sea are of importance and the focus lies on sustaining a healthy environment and expand the renewable energy.

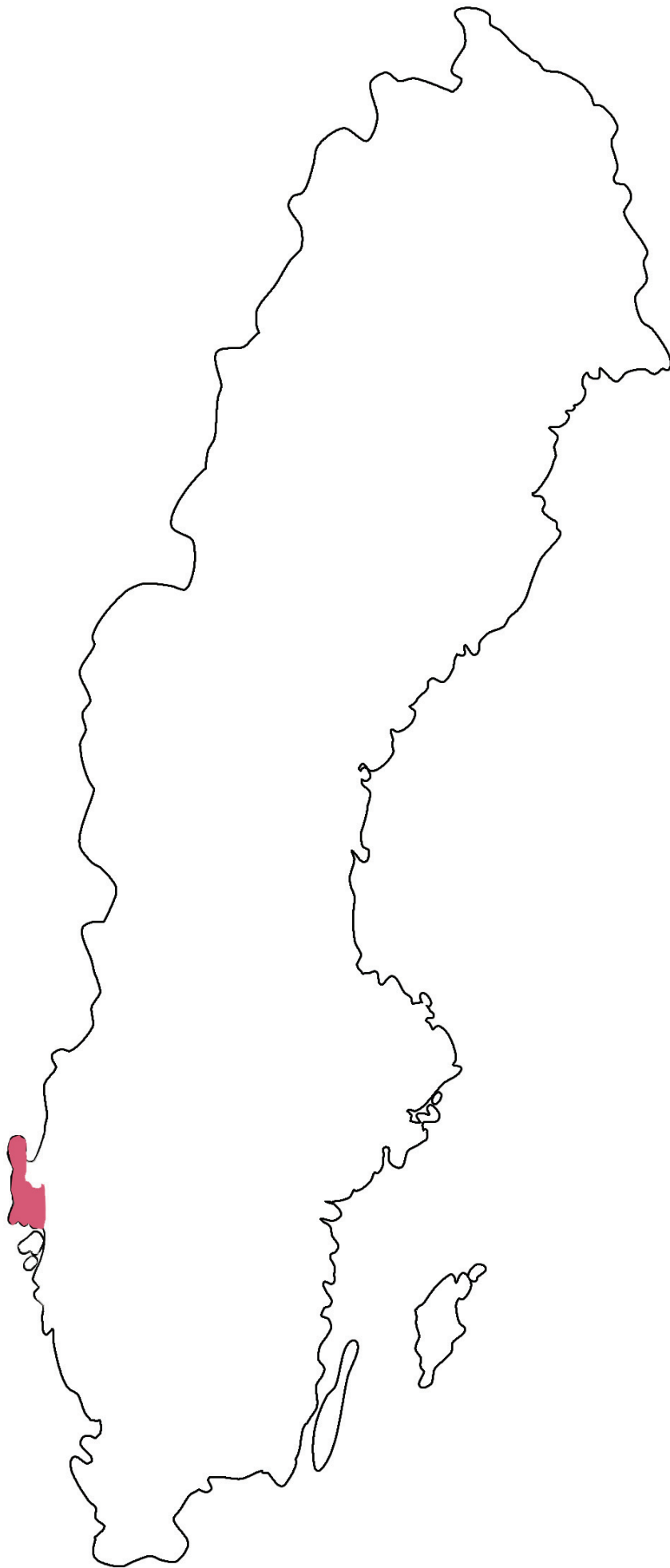
CRITIQUE OF REGIONAL GUIDELINES

CAR DEPENDENT DEVELOPMENT

The E6 contributes to many positive aspects in the region but has also given rise to a car dependent development with less emphasis on sustainable transportation.

STRONG FOCUS ON ECONOMIC GROWTH

The car dependent development and the high Norwegian purchasing power makes it easy for the municipalities to focus on economic growth which leads to investments in external commerce and summer housing. This could lead to a loss of identity with similar development in all municipalities and the unique qualities of each area are at risk of getting lost. Locals can not afford housing and the centralization of markets could lead to a loss of inhabitants to larger cities. A more site specific development where the different municipalities focus on different markets would support the Functional Region and offer a broader diversity in the region as a whole.



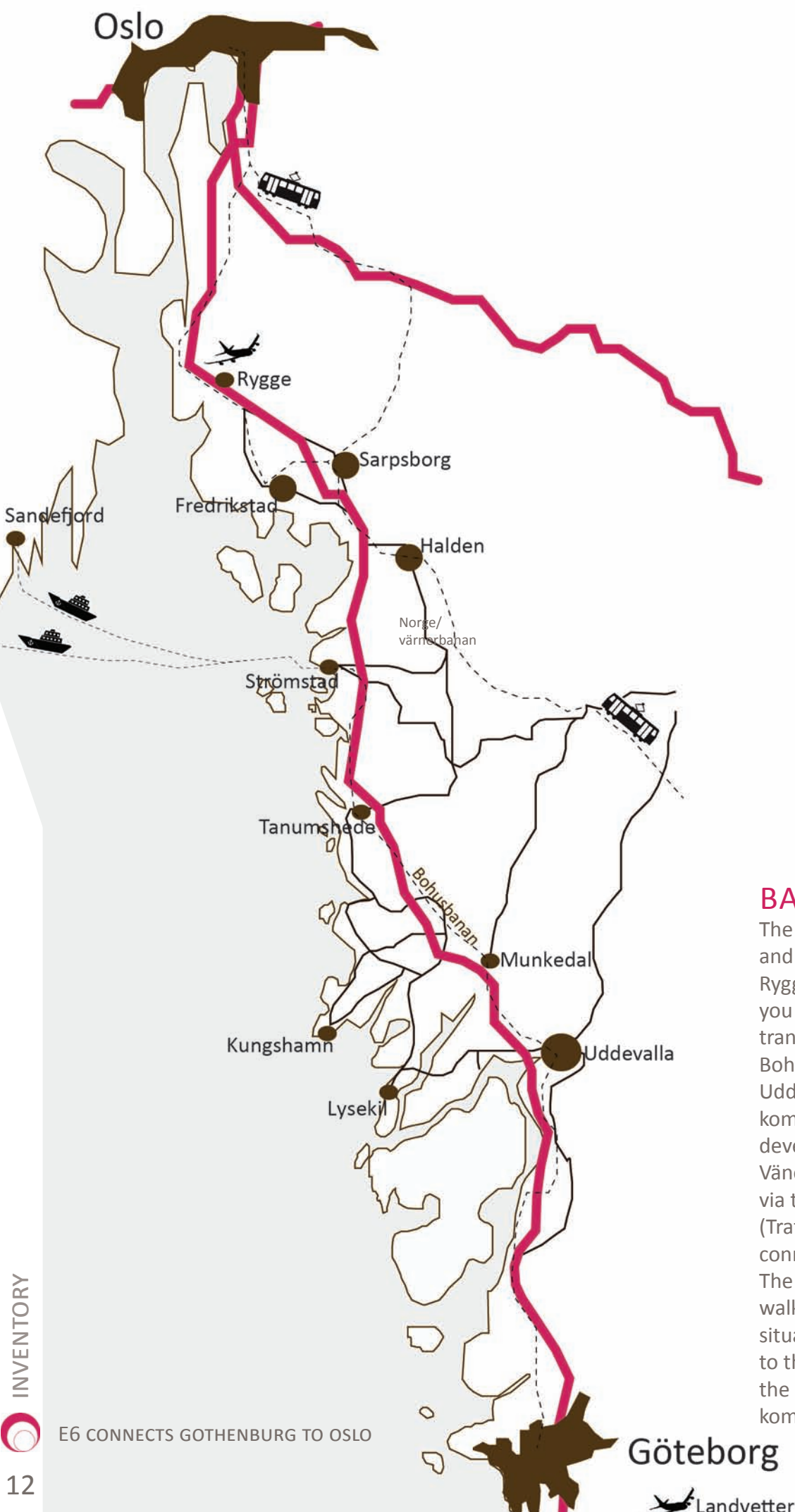
LAYERS IN THE LANDSCAPE

Method

From a vast research and understanding done by the whole class regarding different aspects on the regional scale we have extracted the most important findings according to us. Those findings are shown on seven different maps and form part of the base of our further studies. The area studied is in the north of Bohuslän around the E6, shown on the map to the left.

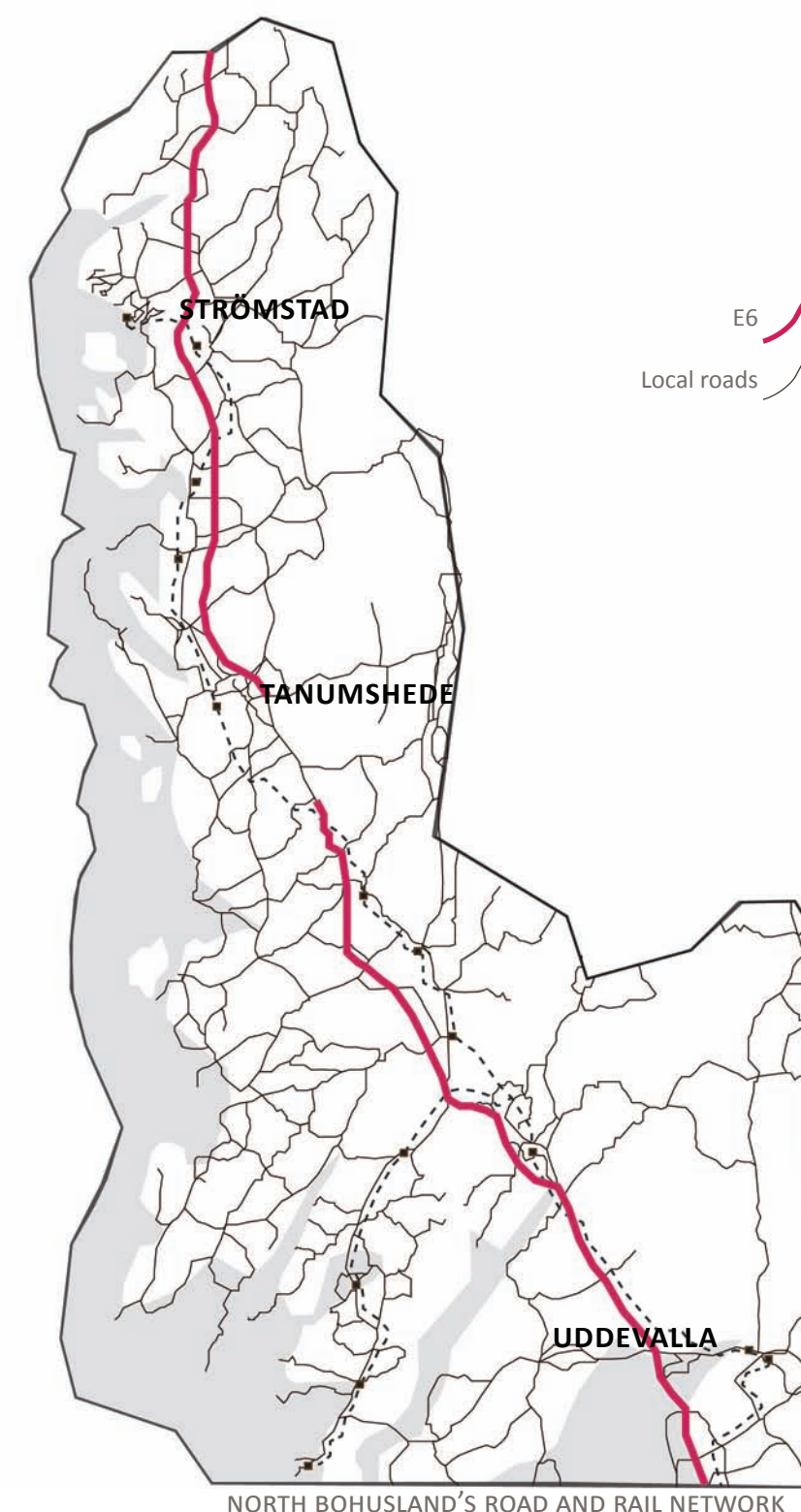
Our approach

Our approach has been to deepen the understanding for the large scale region and to comprehend the important connections to surrounding regions. We have done this from a holistic point of view where the different layers in the landscape are in focus.



BASIC CONNECTIVITY

The E6 connects the west coast to Europe and Gothenburg in the south and Norway and Russia in the north. The closest airport can be found in Rygge in Norway and Landvetter south of Gothenburg. From Strömstad you can also travel by car ferry to Sandefjord in Norway. The ferry transports 1 200 000 travellers a year (Strömstad kommun, 2013). Bohusbanan, a coastal railway, goes from Gothenburg to Strömstad via Uddevalla 4 times a day but the track has a low track quality (Strömstad kommun 2013). The stretch from Uddevalla to Strömstad is expensive to develop and lacks Automatic Train Control. Other than that, the Norge/Värnerbanan, also shown in the map, connects Gothenburg and Norway via the border crossing, but it lacks connection to our investigated area (Trafikverket 2013). Other public transport can be found such as busses connect all settlements in the area using the road network. The high topography in this area makes the nature hard to access and walk lanes difficult to built. The bicycle lanes that we found are mostly situated in and between the bigger settlements. Biking is also directed to the local road system where the traffic is not too heavy. The roads in the inland are very narrow, winding and poorly maintained (Strömstad kommun 2013).



NORTH BOHUSLAND'S ROAD AND RAIL NETWORK



- Forested land
- Agricultural land
- Urban areas

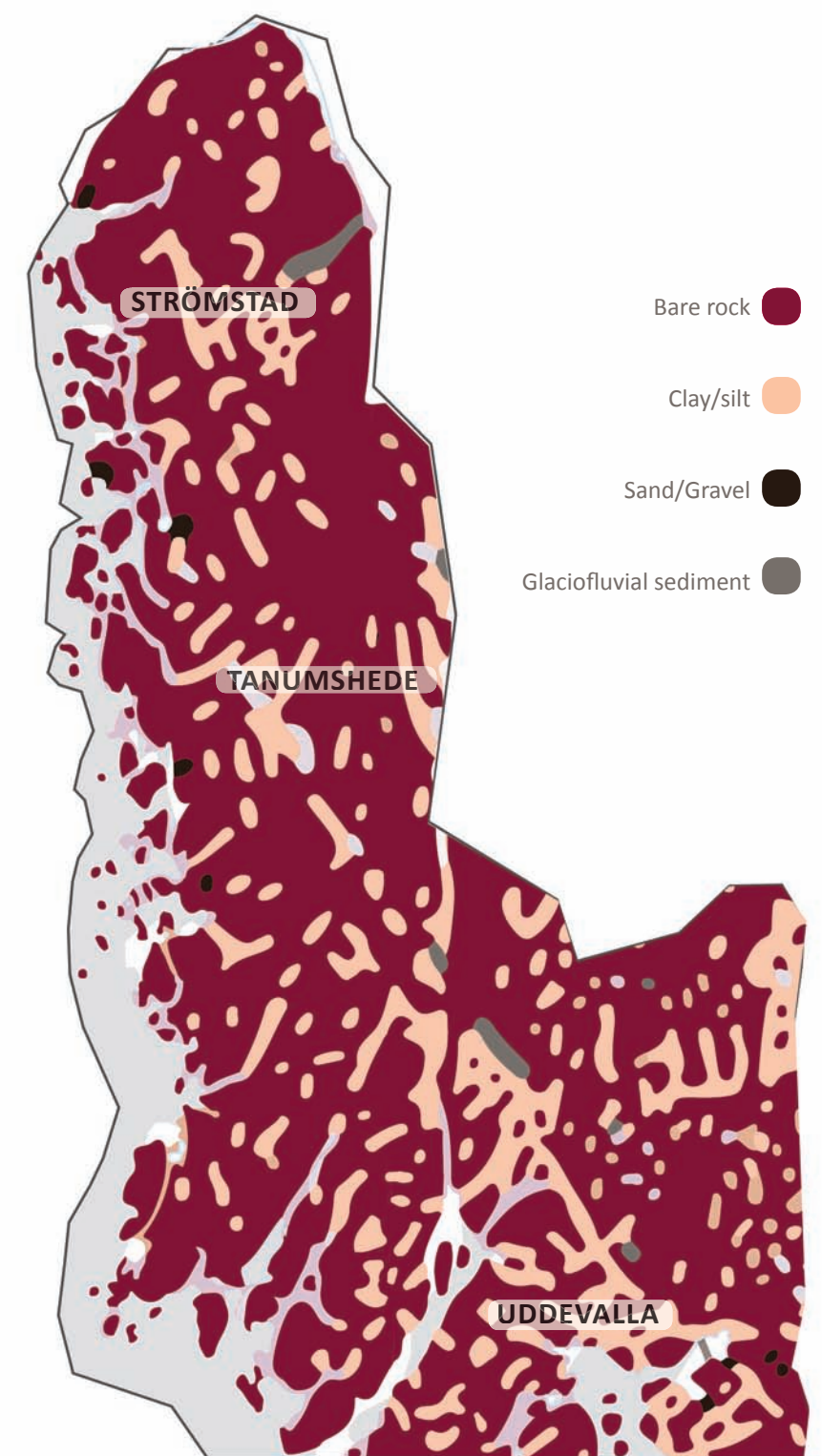
LAND USE MAP

← LAND USE

Most of the land in the region is covered with forest, which plays a special role in the region. The forest is mainly used for forest industry but high natural-valued areas for conservation and recreation is also to be found. The second biggest part of the land is a mosaic of agricultural land patches, being denser closer to the coast. These patches are located on fertile soils, not abundant in the region, on lowlands or valleys which gives the proper conditions for agriculture. Their distribution contributes significantly to the image of the landscape with its open-close structure. Finally, the urban areas are sparse in the region, mainly settled along the coastline. Years ago the main industry was fishery and that determined the settlements location close to the see. Now the region have a strong focus on tourism and summer-housing.

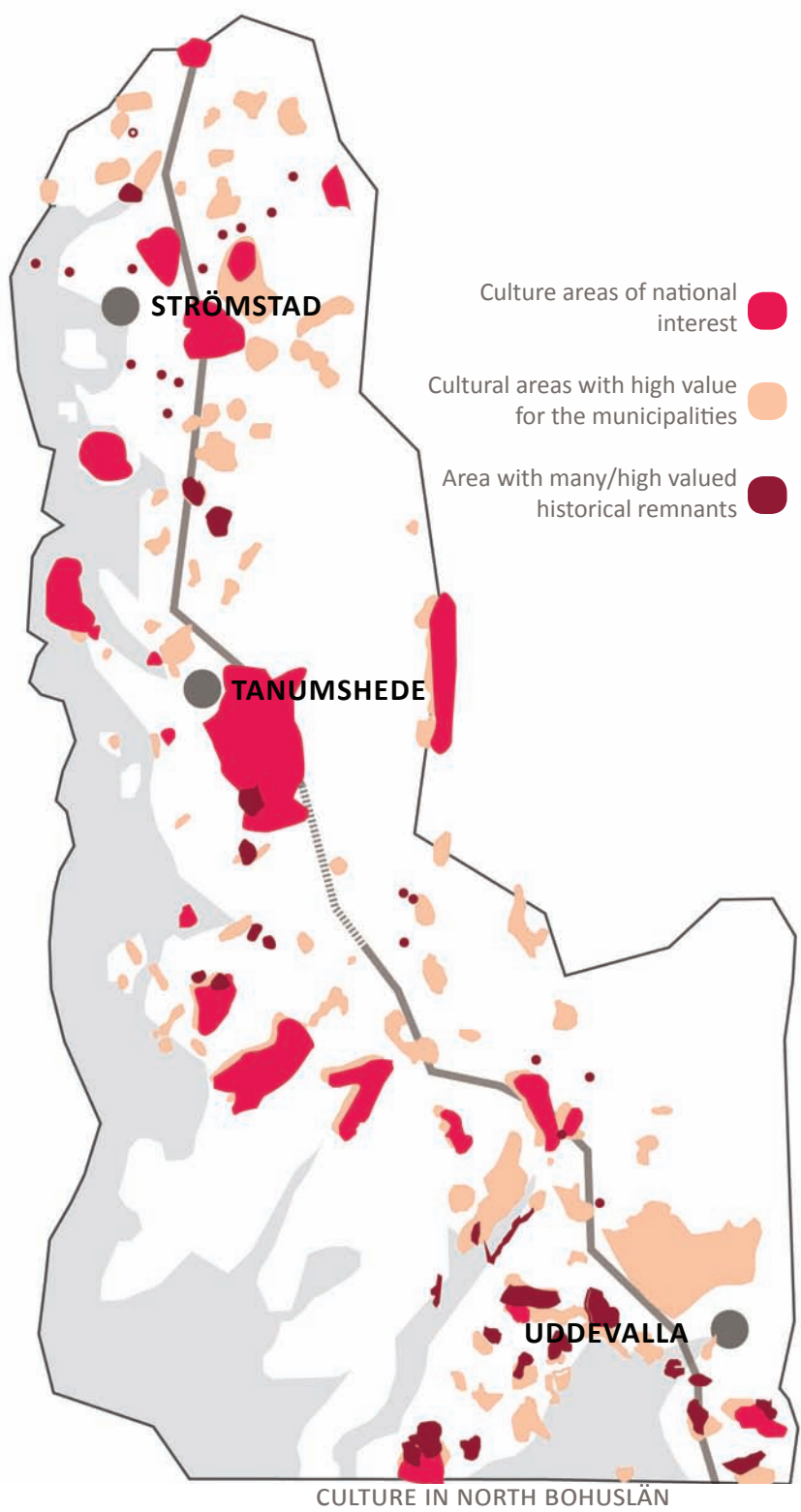
SOIL →

The topography of the whole region reflects the effect of the Ice Age which is represented by its rift valley structure. The area presents a very homogeneous geology pattern with a lithology of granite and pegmatite. This kind of bedrock indicates poor acidic soils. This, together with the predominance of bare rock as soil type creates bad conditions for agricultural uses and hence, a lot of areas are forested. Clay, silt and sediment patches are spread around the region forming a mosaic that characterizes the landscape offering this open-close structure. In the valleys of the west, there are old seabed sediments that are mostly from marine origin, including a part of shell, gravel and marine-deposited clay. Less extensive, there are also patches of glaciofluvial sediments, moraine, sand and gravel.



- Bare rock
- Clay/silt
- Sand/Gravel
- Glaciofluvial sediment

BASIC GEOLOGY MAP



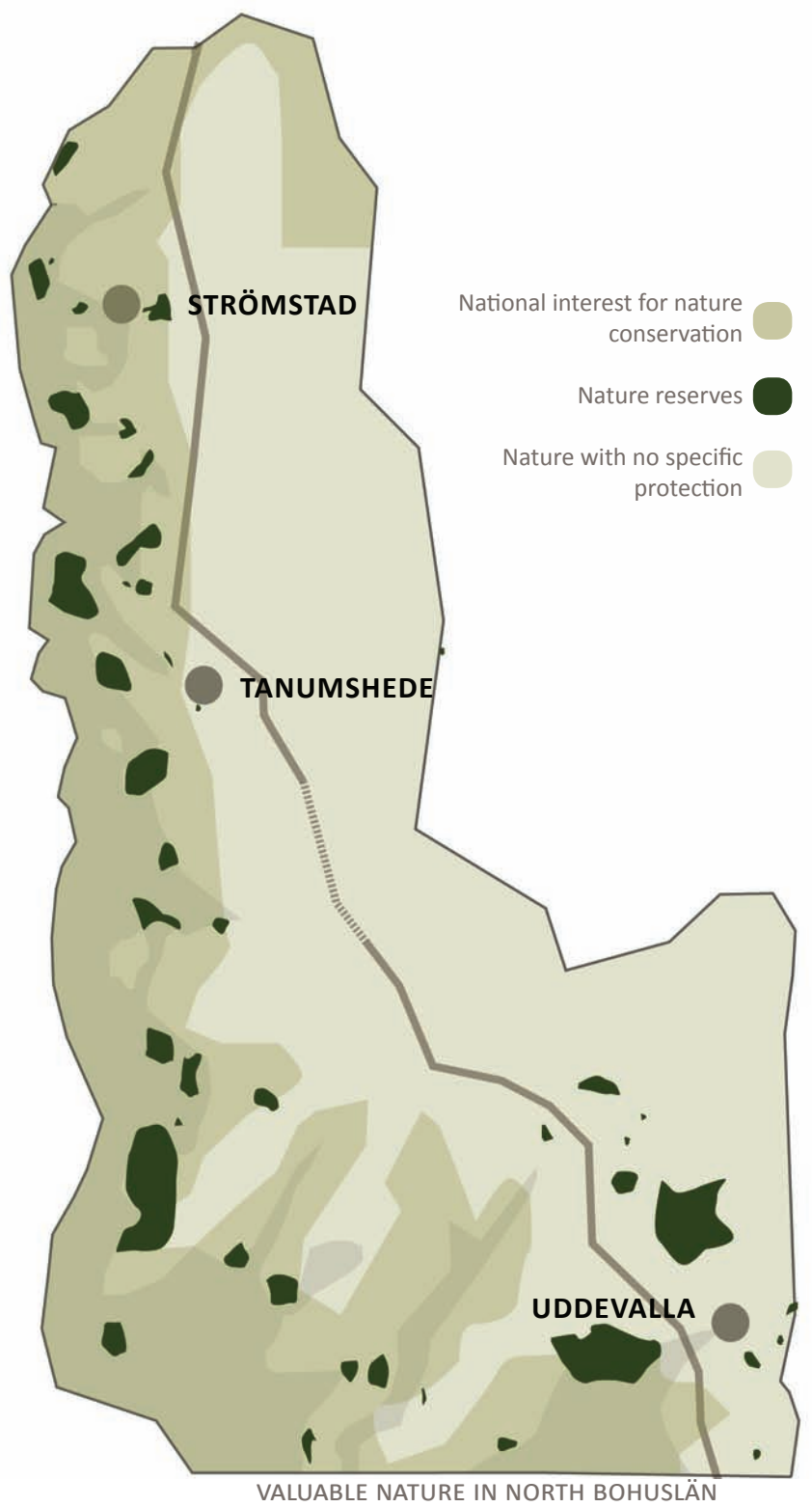
CULTURE IN NORTH BOHUSLÄN

← CULTURE AND HISTORY

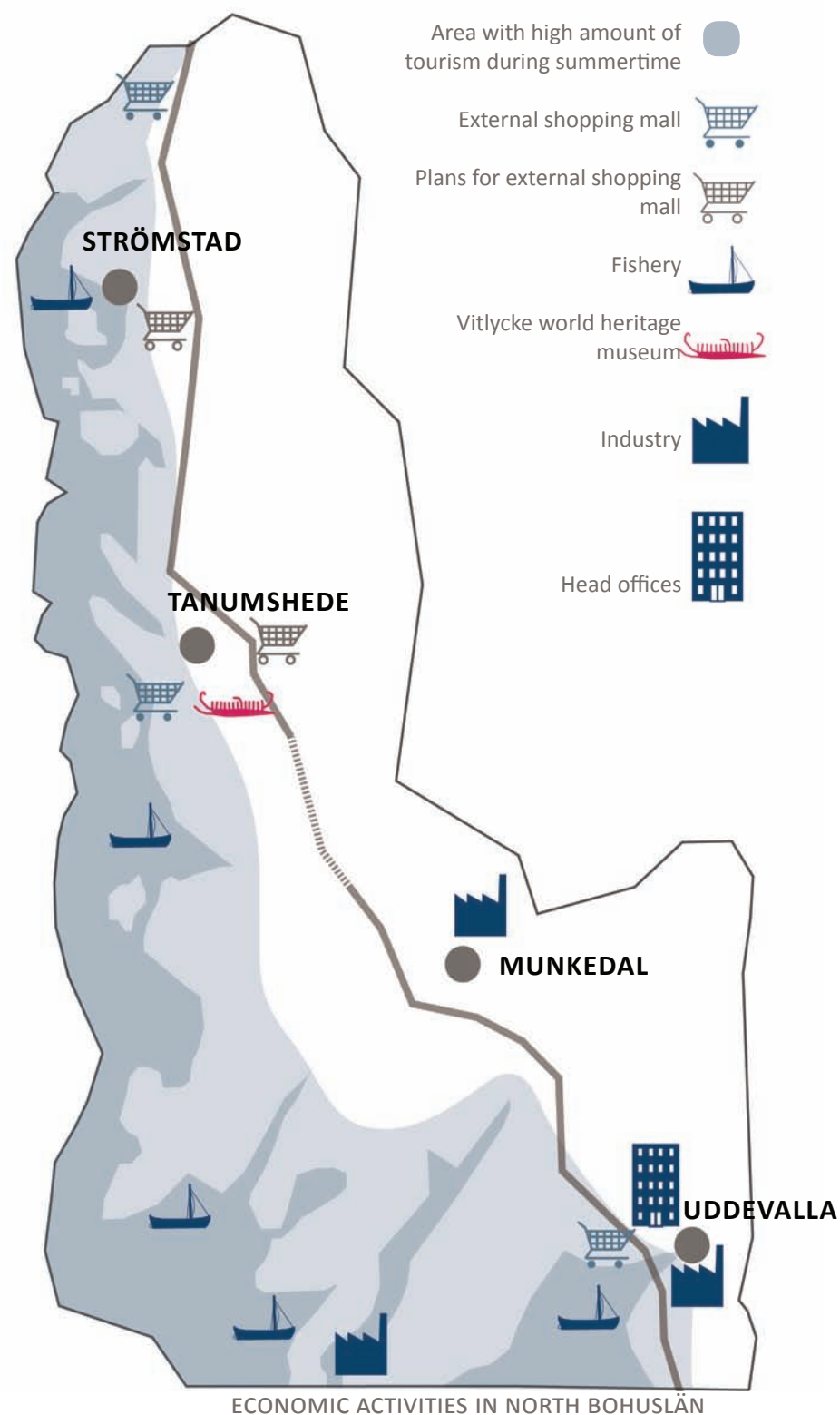
There are a lot of historical findings in the region and the first trace of human settlers is from 10 000 years ago. Most findings are from the Bronze Age in the form of rock carvings. The rock carvings are found all over the region but the most accessible ones are located within the World Heritage Site in Tanum. The historic settlements were mostly located along the coast, which back then was at an altitude of 15 to 110 meters above today's coastal line (Ericsson 1984).

NATURE VALUES →

Due to the dramatic topography with high hills and deep valleys and the varied soil cover this is one of the most varied landscapes in Sweden. This gives the region a rich biological life (Trafikverket 2011) but also a varied landscape that could attract people for recreational purposes. Today the coast is exploited and well used while the inland is unutilized for recreational purposes. The coast is also covered by many protections where the national interest for nature conservation and the nature reserves are shown on the map to the right.



VALUABLE NATURE IN NORTH BOHUSLÄN



← ECONOMIC ACTIVITY

STRÖMSTAD MUNICIPALITY

The economic activity in Strömstad has grown a lot during the last 10 years which could be explained by the strategic location close to the Norwegian border. Another reason for the economic growth in this area is the intensive coastal tourism, Strömstad has 3.6 million tourists visiting every year, one million more than Stockholm. They have an extensive experience Industry of which the commerce is a big part. Other important industries in the area are knowledge based businesses, services and amenities and marine industries and handicrafts. Investments on infrastructure has helped Strömstad become more available and attract more businesses (Position Väst nd).

TANUM MUNICIPALITY WITH TANUMSHEDE AS MAIN SETTLEMENT

Tanum municipality are planning to build a shopping mall in connection to the E6 and explains how the closeness to Norway enhance the demand on shopping possibilities. In Tanumshede the visitor industry is very big due to the World Heritage Site in Vitlycke. There are over 100 000 tourists coming here from all over Europe every year to see the rock carvings. Entrepreneurship is a trademark for the people in Tanum, one of the largest sport shops of scandinavia is located in Grebbestad (Position Väst, nd).



MUNKEDAL MUNICIPALITY

Since many years the paper industry with Arctic Paper is the foundation for the business activity in Munkedal. Also the closeness to E6 and the good railway connections with Bohusbanan and Lysekilsbanan makes the municipality successful when it comes to connectivity. There are six connections to the E6 inside the municipality borders so the connection to Oslo and Gothenburg is very good from all localities in the area (Position Väst nd).

UDDEVALLA MUNICIPALITY

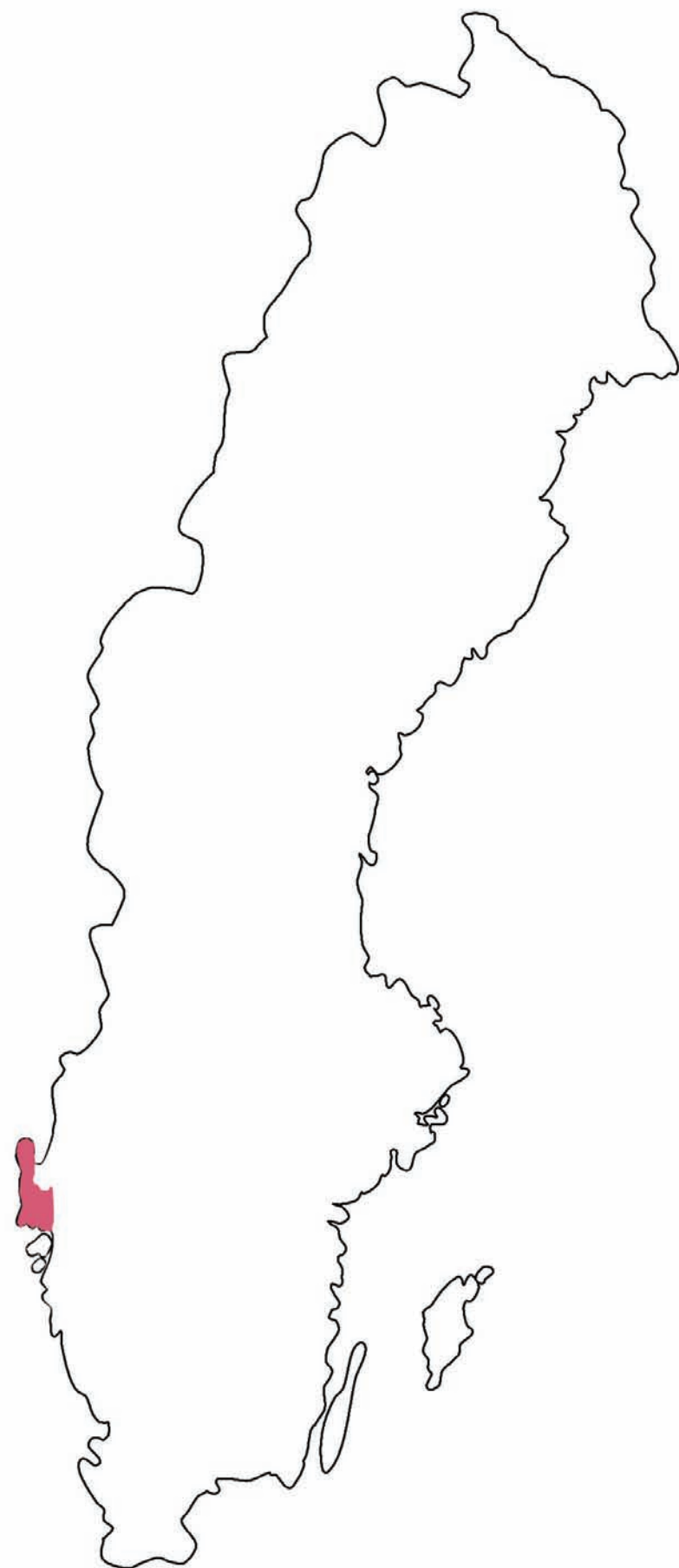
Being the biggest city in Bohuslän with good connections to both E6 and the shore, Uddevalla has been chosen by many companies as the place to locate their head offices. Uddevalla has great logistic benefits with the location between Oslo and Gothenburg that is good for both industry and trade. There are 5000 active businesses in the area and trade, construction, building materials and maritime industries are the main activities. The external shopping area, Torp, outside Uddevalla is well connected to the E6 and has been expanded during the past years, the latest addition was IKEA (Position Väst nd).



ANALYSIS

LCA - CHARACTER TYPES

PEBOSCA AND SWOT



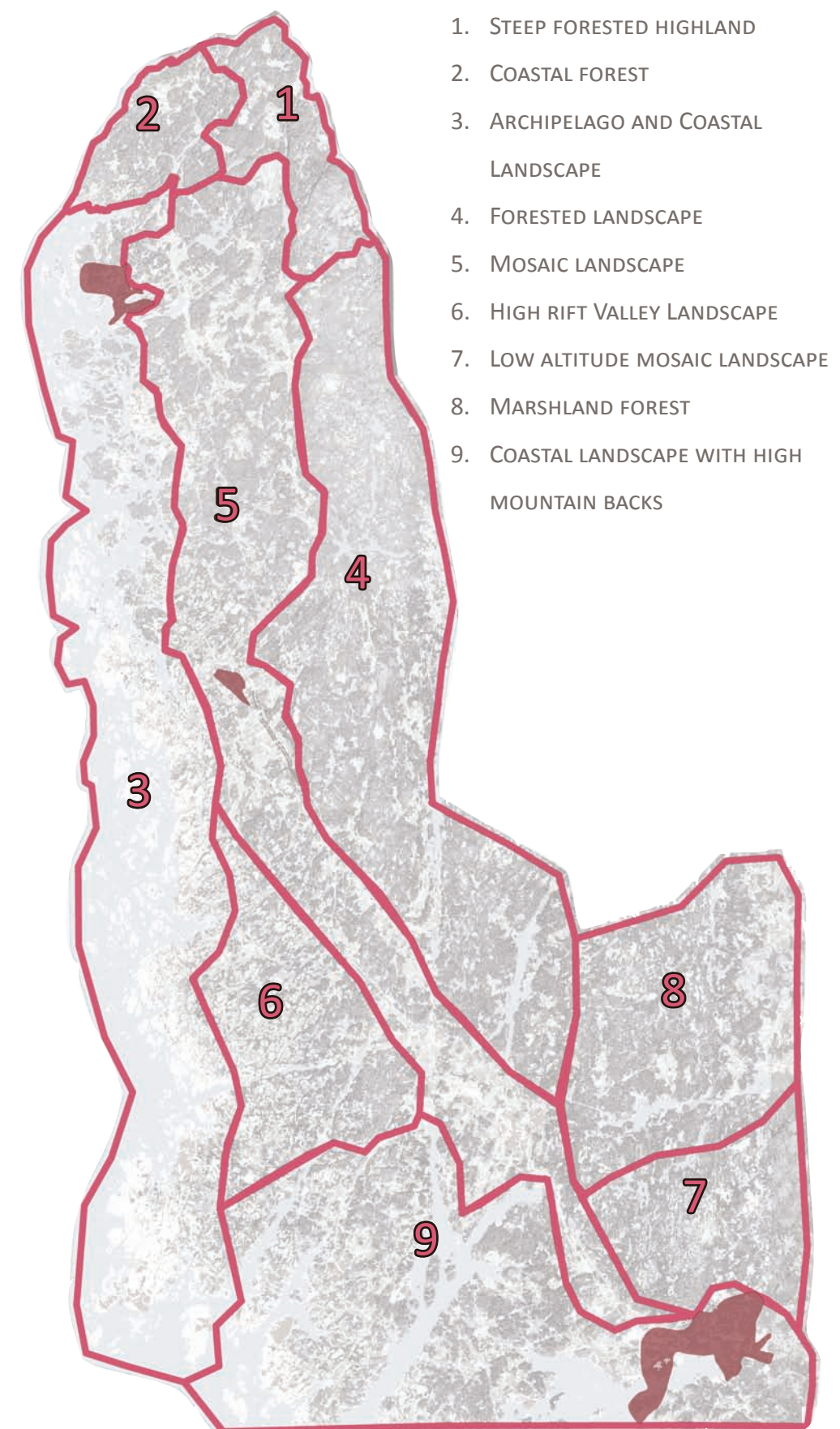
LCA - CHARACTER TYPES

Method

We have used the method Landscape Character Assessment (LCA) as a tool to describe the landscape. It helps us identify the features that gives a locality its 'sense of place'. The LCA was founded in England about twenty years ago. LCA offers different tools that can be combined to meet the purpose of the study (Scottish Natural Heritage 2002). The area we have investigated is shown on a Sweden map to the left and on the right our different character types are shown.

Our approach

On this large scale analysis our main source has been maps from GIS and the municipalities. The time frame within the course restricted us in doing site visits on the larger scale. Therefor the LCA lacks comments on the sensory scale. This analysis describes different character types and omits the next stage with defining character areas.



LCA STUDY- NORTH BOHUSLÄN



Source: M.Ignatieva

*“Som blågrå dyning bohusbergen rullar
i ödsligt majestät mot havets rand,
men mellan dessa kala urtidskullar
är bördig jord och gammalt bondeland.
Dit tränger Skagerack med blåa kilar
och strida strömmar klara som kristall
och lummig lövlund står med björk och pilar
och ask och ek vid ladugård och stall.*

...

*Kom ut till stränderna, de ödsligt sköna
med slån och hagtorn, böjda djupt av storm,
med gamla båtvrak som har mulnat gröna,
men än, i brustna skrov, bär vågens form!
Där, mellan hav och land, på sand som skrider,
på tång som gungar, kan du ensam gå,
och leva i de längst förflydda tider,
och i ditt släktes framtid likaså.”*

-Evert Taube

The beloved Swedish sing and song writer describes vividly North Bohuslän’s magnificent landscape. He describes beautifully the changes and modulation of the landscape and the crisp and clear presence of the water. Evert Taube also emphasise the primordial visual and spiritual landscape of North Bohuslän.

The LCA is done in a landscape highly shaped by the inland ice. The landscape has a strong visible direction with an undulated terrain. The rift valley landscape holds deep fjords and smaller lakes and bogs. This is a sparsely populated area of Sweden with a visible historical landscape.

1. STEEP FORESTED HIGHLAND

This landscape type has a dramatic topography with **steep cliffs facing the fjord**. Visible rifts cut through the landscape from the northeast to the northwest, creating a clear direction in the landscape. Local roads and agricultural patches are mostly located in the lowlands surrounded by dense forest. The landscape is **shady** and protected thanks to the hillside on the opposite side of the fjord.



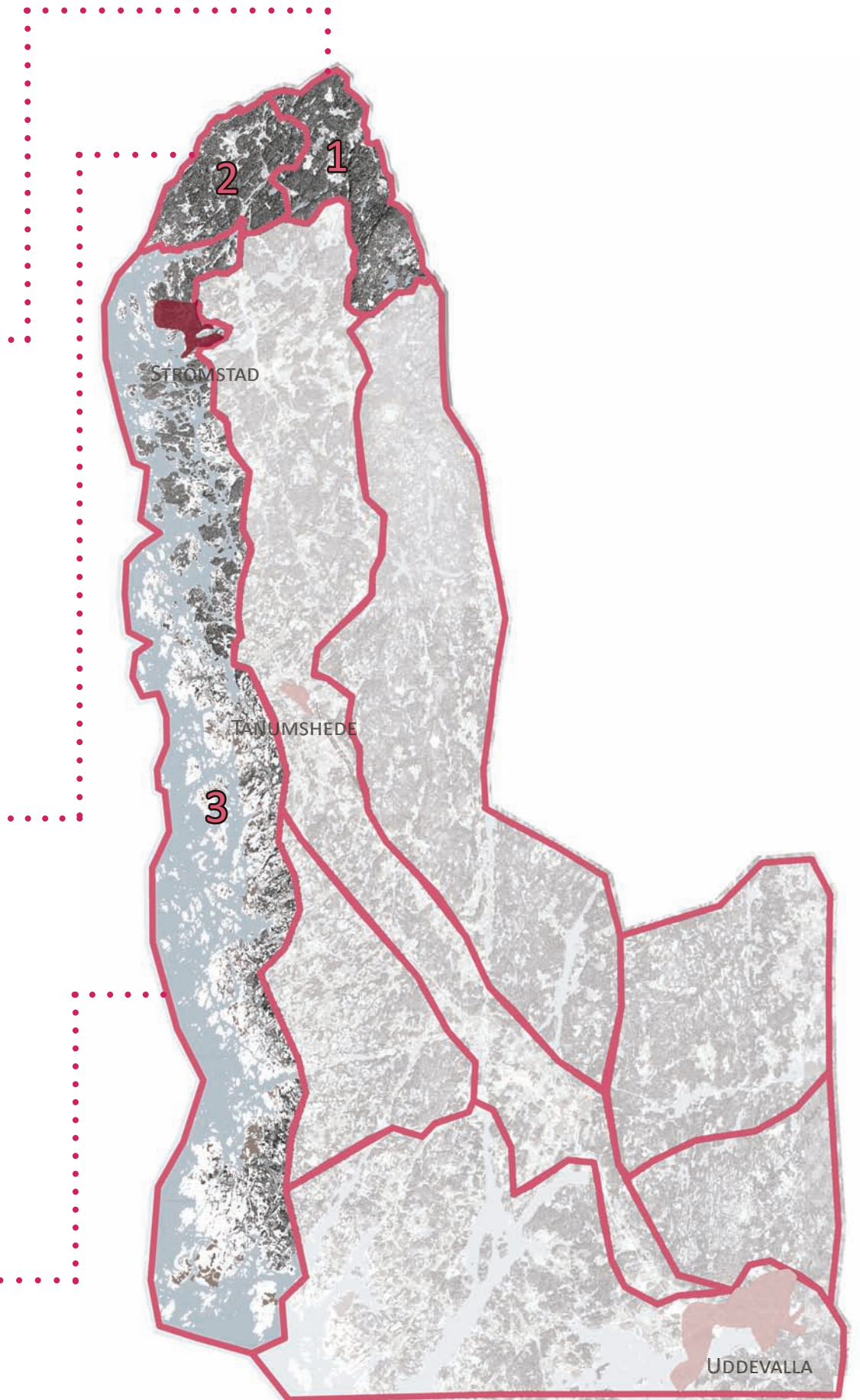
2. COASTAL FOREST

This landscape has a dramatic topography with barren steep mountains facing the sea and more dense forest further inland with mostly **coniferous trees**. The landscape has few lowlands made by former sea beds with smaller clusters of broad leaved and mixed forest. The area is affected by salt and wind from the sea. Except from a fairly **uninterrupted forest** with sparsely located settlements the landscape holds a few dense patches of **summer housing** along the coast.



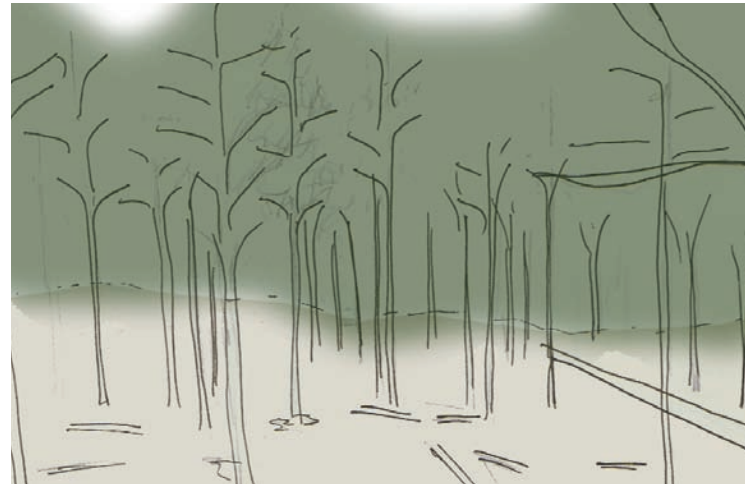
3. ARCHIPELAGO AND COASTAL LANDSCAPE

The Coastal landscape is characterized by the **exposed barren cliffs** facing the sea. The coastal line is discontinued holding **islets** in different sizes and **bays**. Steep mountain sides frame the lowland of the bay where most **summer houses and camping areas** are located in dense clusters. Small scale farming and pastures occurs irregularly inland in the valleys. Other characteristic elements in the landscape are the leafy fringes of forest between the mountain sides and the open lowland holding heather moorlands. The road-network is small scaled and narrow roads wind along the lower rift valleys.



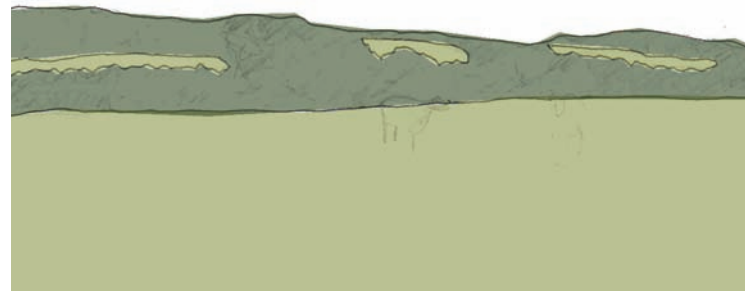
4. FORESTED LANDSCAPE

The landscape type is defined by a cover of mixed forest with mainly coniferous trees. The **forest industry** is visible in the landscape with clear cuts in different scales. The rift valley landscape is visible and contains inland lakes and marshlands. The topography reaches between 100 to 240 meters above sea level. The landscape type has predominantly bare rock with thin or discontinuous soil cover. The bare rock consists of only granite. The landscape is **sparsely populated** with settlements located close to lakes. The main roads winds along the rift valleys and into forested areas or settlements.



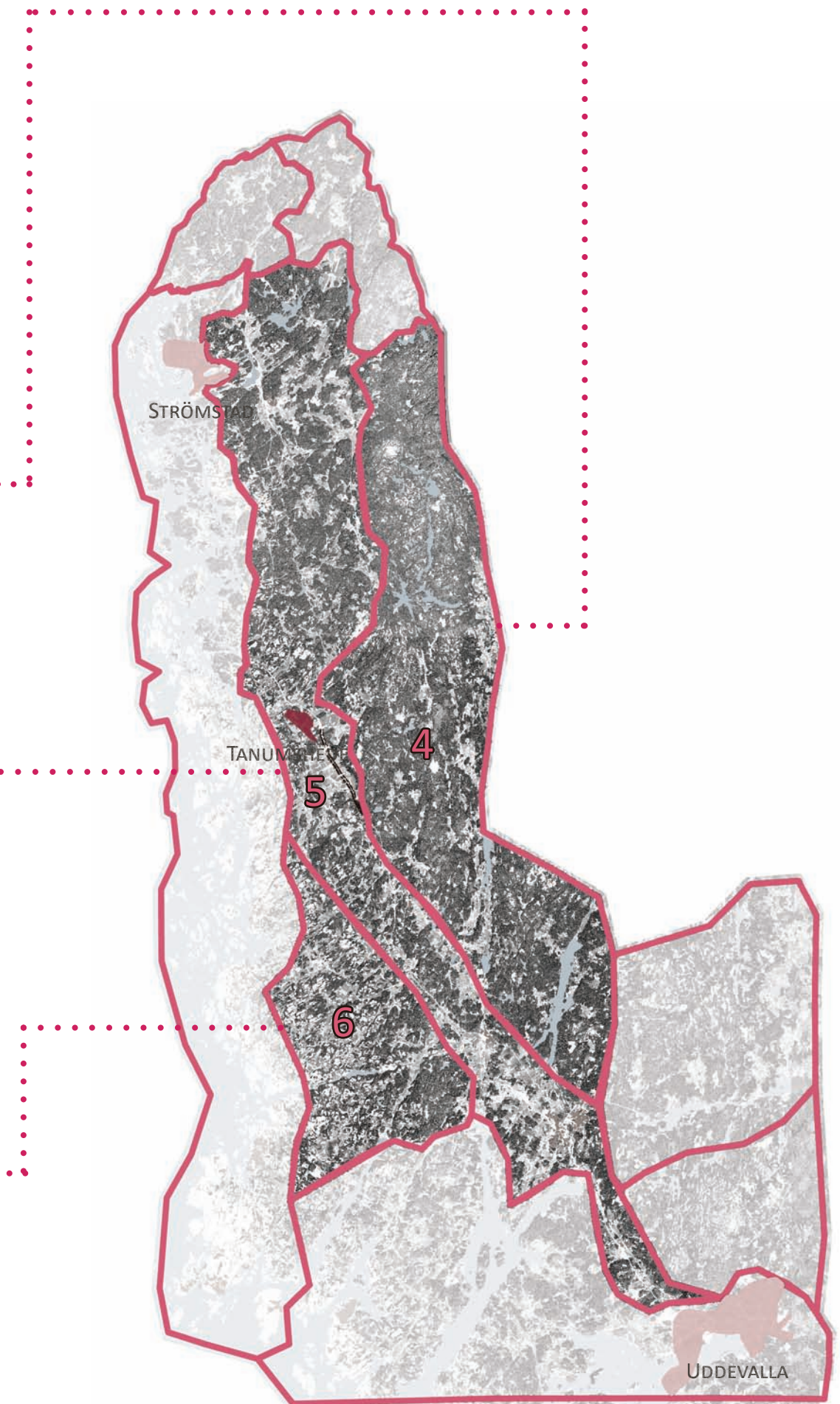
5. MOSAIC LANDSCAPE

The mosaic landscape includes many and large **patches of forested and agricultural land**. The topography is flatter than in the coastal areas and the direction is less prominent than that in the coastal areas. Coniferous forest dominates the higher altitudes while the valleys contains open/cultivated land. Open areas are mainly agricultural land but also consist of **clear cuts and quarries**. **Rivers** flow along the valleys throughout the landscape. The road networks run along the valleys and are most abundant in the cultivated areas. The largest road **E6** can be found in this area.



6. HIGH RIFT VALLEY LANDSCAPE

This landscape type has a **rolling terrain** shaped by the glacial movements. The area is **higher than the surroundings** and is above the highest shore line. The mountain tops are forested and outlined by dramatic slopes and the landscape contains a drumlin shape with a characteristic **whaleback figure**. Because of the terrain the landscape offers limited views, and is therefor often perceived as small scaled. The cultivated land, roads and buildings lie traditionally along the valleys. The area is outlined by two frequently used roads, the E6 to the west and Road 165 in the east.



7. LOW ALTITUDE MOSAIC LANDSCAPE

The glacial clay soils in the valleys and the rolling moraine hills are the base for this landscape. The landscape is **lower** than the surroundings. Forested hills defines the surrounding fields and grasslands and creates a large **changeable open-close structure**. The forested areas mostly consist of **Abies** with some abundance of *Pinus* and *Betula*. Forestry and cultivation dominate the land use and the landscape has an agricultural history with findings from the Bronze Age. The landscape is rich in water and contains many lakes and streams. The roads are mainly located on the higher plateaus and connect surrounding larger towns.



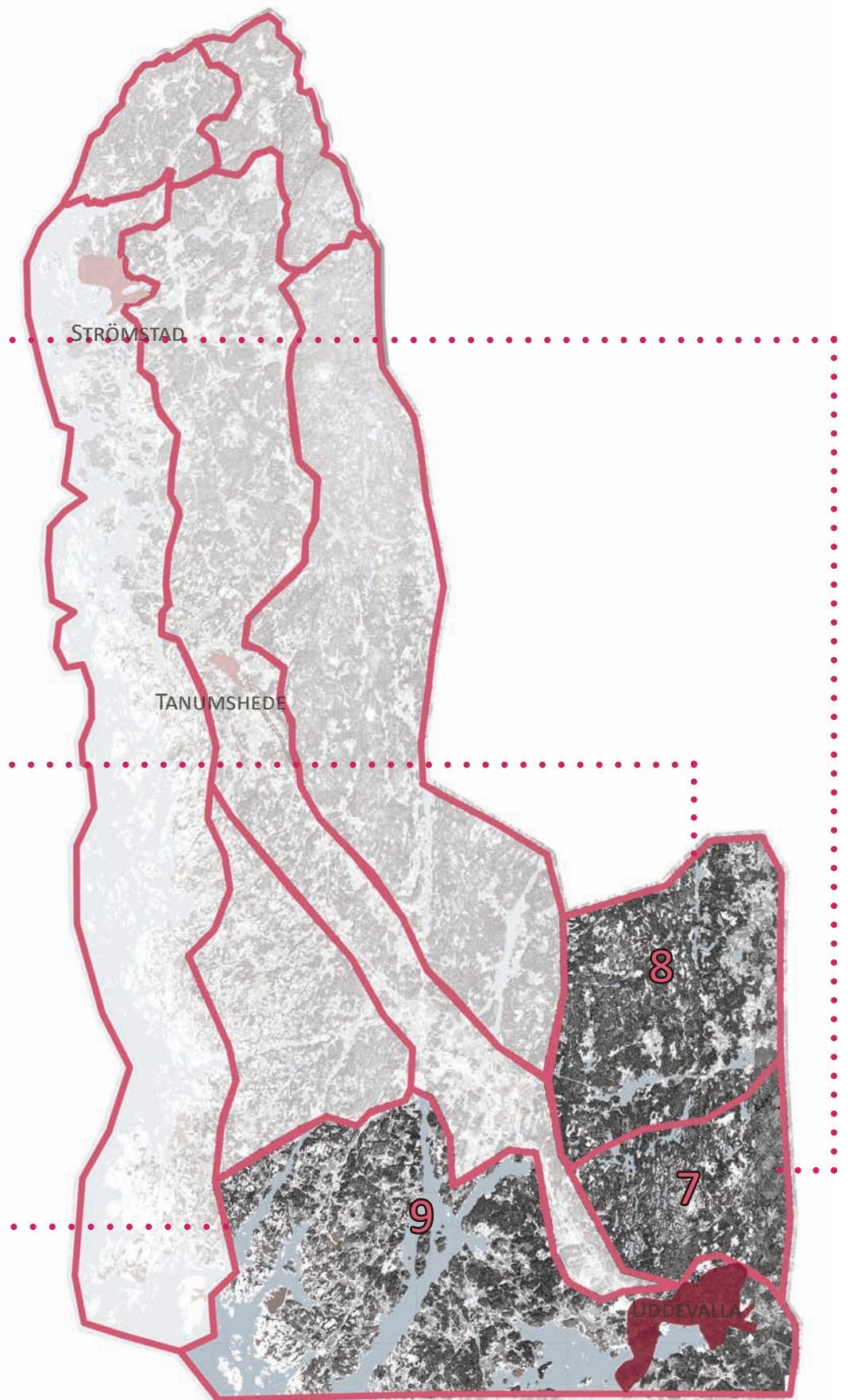
8. MARSHLAND FOREST

The landscape has a high topography with some areas above the highest shoreline (240m). The terrain is covered with coniferous and mixed forest. A lot of water can be found in the area in forms of **lakes, bogs and streams**. Forestry is dominating the land use. Early use of hydropower has supported industries such as iron foundries, saw- and paper mills. The road system and settlements are often located next to waterways, but the settlement is scarce and there has been **little human interference** in the landscape throughout history.



9. COASTAL LANDSCAPE WITH HIGH MOUNTAIN PEAKS

This Coastal landscape has high altitude forested mountain backs around fields with fertile clay soil. The **fjords** contributes to the character and has a strong south-western direction which continues in rift valleys inland. The fjords also create an aesthetic beautiful landscape with many sight lines that gives the landscape a **strong maritime connection**. This landscape type also contains **inaccessible, sparsely populated forest** areas between the fjords and valleys offering a rich recreational experience.



PEBOSCA AND SWOT

Method

From the study of layers in the landscape and the LCA we have gained knowledge that serve as a base for the analysis under this chapter. PEBOSCA is a framework under the provision of the UN Habitat Agenda and aims to provide a comprehensive analysis over the resources within an area. The resources studied are the **Physical, Economical, Biological, Organisational, Social, Cultural and Aesthetic** (Berg 2010). We have chosen to combine the PEBOSCA analysis with the SWOT in order to get a clear view of problems and challenges. The findings from the PEBOSCA are categorised under the SWOT headlines which are **Strengths, Weaknesses, Opportunities and Threats**.

Our approach

By doing this analysis we have deepened our understanding for the region. We have also been able to see the common challenges for the region. This helped us formulate possible solutions.

PHYSICAL

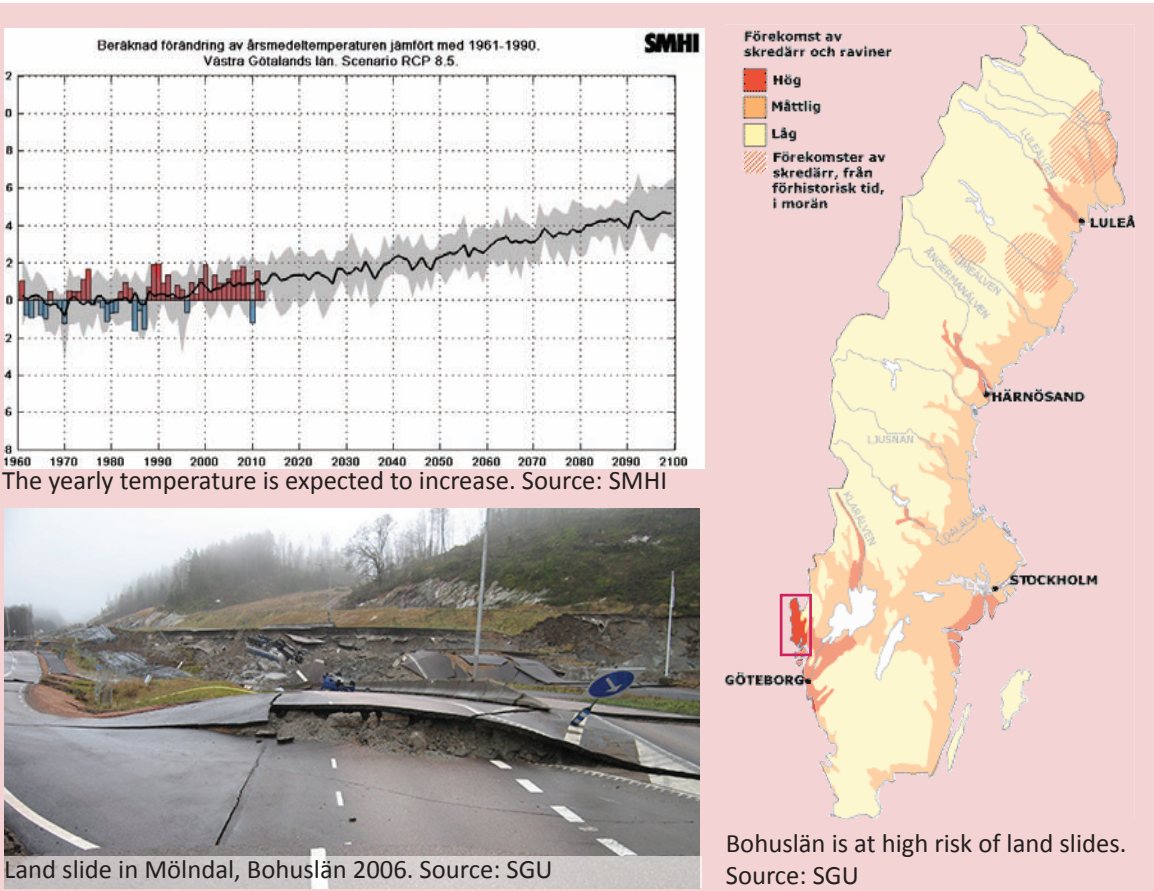
The area is situated in a rift valley landscape with a homogenous geology pattern. The whole area is represented by a lithology of granite and pegmatite. This kind of bedrock indicates acidic soils which are poor soils. The zone is also characterized by its richness in base metal minerals (Cu, Zn, Pb, Co, Ni, etc). The soil cover is discontinuous with bare rock, but patches of clay and silt can also be found (SGU 2013).

In the area a lot of small mining industries can be found cause Bohuslän granite has been an attractive stone in many years (Länsstyrelsen 2013).

The expansion of renewable energy production is prioritized. Between 2008-2010, the production of wind power has almost doubled (Västra Götalandsregionen 2012).

In the recent past, global changes have increasingly caused more precipitation which affects the water level in rivers hence increasing the risk of flooding and landslides (Länsstyrelsen Västra Götalands län 2012).

The E6 is an essential construction that runs through the region. It serves as the main transport road from north to south. It's also a generator for development of commercial areas and new housing along the stretch. The coastal area is of a high value for recreational, commercial and natural values.



S Large supply of the attractive Bohus Granite rock which is stable to build on. The rock is also a barrier, preventing maceration of nutrients

Large presence of water and nutrient rich soils

Climate conditions suitable for renewable energy

Coastal and rift valley unique landscape with little exploitation

The geology conditions with bare rock and a dramatic topography provide challenging conditions for an expansion of the transportation network in a sustainable way, without blasting.

W

The restricted amount of agricultural land

Barren climate with high precipitation and wind

Development of more permanent housing

Expansion of renewable energy, such as wind power

Develop markets and settlements along E6 with high connectivity

Improve the waterway connections from the south of Sweden to Norway

With climate changes and higher precipitation the area is prone to landslides and sagging due to soil conditions

Closeness to the sea makes the area more vulnerable for future sea level rise

The development of E6 promote further unsustainable development of car dependent settlements and commercial areas aside the road

T

CONCLUSION

A moderate development in Bohuslän makes the area's raw material supply large and available. This is a large opportunity for the region to develop alternative energy, recreation and a strong economic market.

The E6 contributes to an attractive region but has negative effects on nature and future car dependent development.

ECONOMICAL

The economic core of this area is Uddevalla. Uddevalla has one of the country's biggest port which is directly connected to the national rail and roads (Uddevalla nd).

The area provides a good opportunity for smaller craft companies with many summer houses that need maintenance. The need of academic work is low. (Strömstad kommun 2002).

Västra Götaland is an area of high interest for tourism. The municipalities focus on developing the areas along the coast for tourism focusing on new recreational areas and a more accessible coastline (Strömstad kommun 2002, Tanumshede kommun 2002, Uddevalla kommun 2010, Munkedal kommun 2010).

Because of the tourism the area face a problem with not enough financial support for a development. Many part-time residents do not contribute to the municipality's income in form of taxes. Therefore the municipalities work for an easy transformation of summer houses to permanent housing and an extension of the tourist season offering a variety of attractions (Strömstad kommun 2002, Tanumshede kommun 2002, Uddevalla kommun 2010, Munkedal kommun 2010).

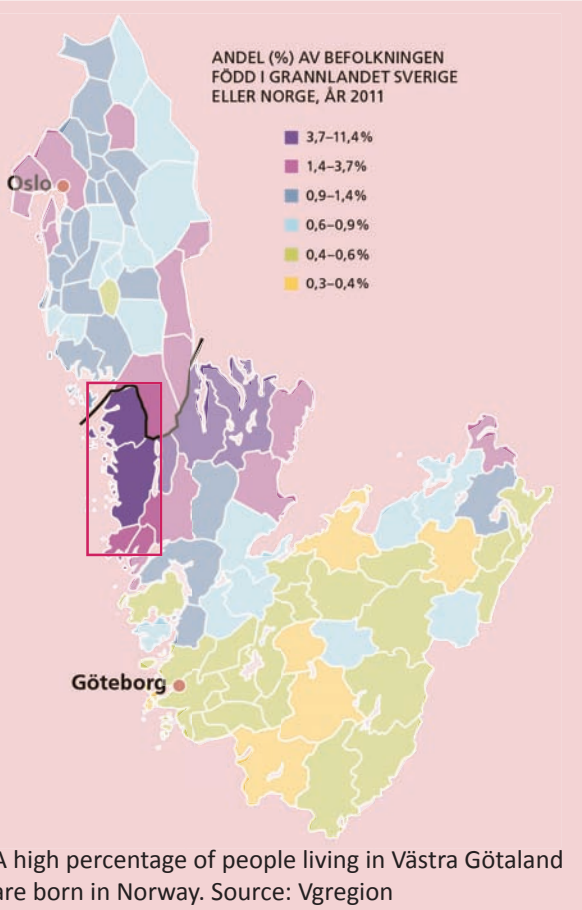
The closeness to Norway strengthens the region economically. From Norway comes the most purchasing power. Norwegians have summer houses around the region and shop at the Swedish malls close to the border.



Uddevalla port. Source: M.Ignatieva



Stereotypic picture of Bohuslän. Source: VästSverige



A high percentage of people living in Västra Götaland are born in Norway. Source: Vgregion

S Located between two larger cities; Oslo and Gothenburg

The region has a strong brand and an already well established tourism

Deep-sea ports of national and international interest

O Extension of tourist season and a spreading of attractions around the region

A progress that result in a thriving region that provides a diverse market and a popular place for tourism and living

A positive development and usage of the closeness to Oslo and Gothenburg

W Few all-year-around settlers that pay taxes to support e.g. the infrastructure that is needed in summer time

Hard climate for companies requiring higher educated workers

Hard to commute or long travelling time, especially for public transport

Dependence on the Norwegian purchasing power

A change in the Norwegian economy will dramatically affect the region negative

Risk for a continuation of centralization of markets that will affect the smaller towns

T

CONCLUSION

The region has a stable base for a growing economy, situated between Oslo and Gothenburg. On the other hand the regional economy is fragile with a high dependence on Norway and a futuristic common goal to focus on tourism.

BIOLOGICAL

The blue and green structures in the region hold important resources such as a rich flora, high biodiversity with many red listed species and areas under protection. The coastal area is of specific high significance because of its recreational value but also because of specific costal biotopes. These areas serve as a base for biodiversity and ecosystem services in the region (Botaniska föreningen Göteborg 1999).

The E6 has created a barrier through the landscape with fragmented habitats and polluted waterways to follow.

The coastal area is of extra importance and has been named as one of the world’s last 10 wild areas (CNN 2013).

North Bohuslän have a strong blue and green structure with a large structure of informal green areas.



Planning of new service area along the E6.
Source: M. Ignatieva



The rare *Coronella austriaca* (Smooth snake) was moved to a “Snake Hotel” during the building of the E6. Source: M. Ignatieva



S

A rich biodiversity in the region provides ecosystem services

- Unique habitats including old forest and red-listed species add high interest to the region
- High variety of water types and water usage; recreational, industrial and habitat
- High amount of green and blue structure

- Develop recreational areas for educational purposes
- Reconnecting the blue- and green-structure along E6**
- Improve water quality

W

Many specific isolated patches and red-listed species that are sensitive for disturbance

Disturbed and fragmented habitats due to E6 as a barrier and surrounding commercial expansion

Pollution from the E6 with heavy traffic and stockings in the summer

Further development could lead to more fragmentation of habitats and a loss of ecosystem services

New development could lead to a pollution of waterways and damage of protected aquifers

T

CONCLUSION

North Bohuslän has a rich biodiversity and a large undisturbed and undiscovered forest. This is a great opportunity to enlighten the natural values and ecosystem services for locals and visitors.

ORGANIZATIONAL

The regional councils in the north Bohuslän are all of small size and faced earlier a migration of people and closing of industries. Lately the trend has changed and more people are now moving into the region. There is an on-going competition between regions and towns to attract new residents. In that competition local qualities are of importance to attract residents (Internationella Handelsskolan i Jönköping nd).

The different municipalities form part of what is called a functional region. The functional region is normally formed by the flows of workforce and markets. Together the region can stay strong in today’s market economy (Internationella Handelsskolan i Jönköping nd).

The E6 and the railway connect the region from north to south and the boat transport goes along the coast, mainly from Uddevalla and Strömstad up north. The region lacks connections from east to west and between different transport modes.

A sparsely populated region can be a negative factor for a competitive market. There is an opportunity to strengthen accessibility and specialized knowledge in the region (Nutek 2008).

Bohuslän has a valuable position for transnational cooperation and is placed between two important larger cities, Oslo and Gothenburg (Nutek 2008).



Norway-Sweden border.
Source: Gränsetjånsten



A high-speed train in North Bohuslän could shorten the commuting time and improve the connectivity. The old bridge between Sweden and Norway could hold the new railroad. Source: B. Magnuzon

Kommun	Inpendling	Utpendling	Differens
Munkedal	793	1690	-897
Sotenäs	695	838	-143
Strömstad	665	509	156
Tanum	793	1188	-121

Showing the difference between in- and outgoing commuting in four larger towns in Bohuslän 2000. Source: Tillväxt Bohuslän

S

- Population growth
- Good opportunities for handicraft occupation
- Cooperation between cities in what is called Functional Regions
- Benefits from the collaboration with Norway and the closeness to Gothenburg**
- Important north- south connections with E6 and the waterways

O

- Creating different identity and strengths for each municipality and therefore enhance the region as a whole**
- Improve the connectivity in the region
- Development of the transnational cooperation with Bohuslän as a node
- Regional spirit and regional cooperation

- Sparsely populated
- Similar markets and attractions in all municipalities**
- Fragmented region with little collaboration between municipalities
- The market region is held back by the weak connectivity, especially when it comes to public transport and bike paths**

W

- The competition about tax-payers results in a loss of focus on regional collaboration which makes the region weaker and less efficient**
- A change in the larger cities economy will affect the region on a small scale

T

CONCLUSION
At present the poor communication between municipalities and the untargeted development weakens the functional region.

The strategic position between Oslo and Gothenburg is a good base for the region to develop into a socially attractive and growing economy.

SOCIAL

Since 1994 there has been a population growth in Bohuslän and Västra Götaland. They are predicted to grow with an annual rate of 0,5 % to 2020 which is above the national rate average (Västra Götalandsregionen 2009).

Most of the social activities are concentrated around the summer season and the coast. The free and open-living conditions and the concentration of neighbours with the same interest are said to be of high social value for part-time residents (DK. Müller 2010). There is also a high concentration of social activity around external commerce, where the shopping malls act as hotspots for people flows.

The age group between 18-25 years has the weakest growth rate when most young people move to the larger cities in the region (Tillväxt Bohuslän 2012).

Social activities and events are located at the larger towns; Uddevalla, Strömstad and Tanumshede. The municipalities highlight the problem with the lack of cultural and sport centres and want to develop that further on (Uddevalla kommun 2010, Strömstad kommun 2002, Tanumshede kommun 2002)



Music festival at Koster in the end of summer. Source: Kosterfestivalen



An extension of tourist season can involve better ice skating facilities on the lakes. Source: Cykelfjäll



A thoughtful design of public places can encourage social interaction Source: Kosterfestivalen

S

Increasing migration into the region

Many natural meeting spots during summer

Large range of activities thanks to the connection with Gothenburg and Oslo

Low unemployment in the region

Create an attractive area for young people and families

Improve social events and activities throughout the whole year

A relocation of young people

Few social activities in winter

Social activities located mainly in large cities, leaving smaller towns quiet and unattractive

No cultural meeting point for the whole region

A development of external commercial centres could result in a loss of public social places, a death and insecure city core and more relocation of people out of the region

A change in the Norwegian economy will affect the job opportunities

W

T

CONCLUSION

Many social activities are situated in larger towns and the rural area have few social meeting points. The region is an attractive living place, especially during summer, but has a problem with young people moving out.

CULTURAL

The region has a high number of cultural remnants providing evidence of the former land use and giving a historical depth to the region.

The Vitlycke häll and its surrounding landscape is of cultural heritage status and the museum is an important spot for education.

Bohuslän has been under a long time a border region that has changed nationality many times throughout history. This has brought in many different traditions and cultures to the area (Bohusläns museum nd).

Bohuslän has a few large contemporary studios and many smaller local handcraft centres that are mainly located at the larger towns.

“Film i väst” is a fond that support high quality film production in Västra Götaland and contributes to a living culture scene and regional development (Film i väst 2013).



Vitlycke museum. Source: M. Ignatieva



Cultural landscape. Source: M. Ignatieva



Vitlycke häll. Tanumshede

S	<p>A large amount of cultural remnants in the landscape</p> <p>Strong history with fishing industries as the core</p> <p>An old and long history as a border region</p> <p>Well established brand for the region as typical ‘Swedish Summer Paradise’</p> <p>Vitlyckehällen and the museum are important spots for education</p> <p>A large and broad range of culture</p>	W	<p>Spread out historical remnants of value that are difficult to preserve and protect</p> <p>Unnoticeable cultural areas</p> <p>The change of nationality and the history as a border region could divide the region and weaken the identity</p> <p>Old cultural land use is disappearing, such as agriculture and fishing</p> <p>Intensification of valued culture around the largest towns</p>
	<p>Increase the depth and the understanding of the area by making history and culture more visible for visitors and locals</p> <p>Broadening the brand of the area to include more than just the coastal area</p>		<p>New expansion without an understanding of the cultural landscape could result in a loss of important values and identity for the region</p> <p>Heavy tourism can impair the cultural values</p>
O			T

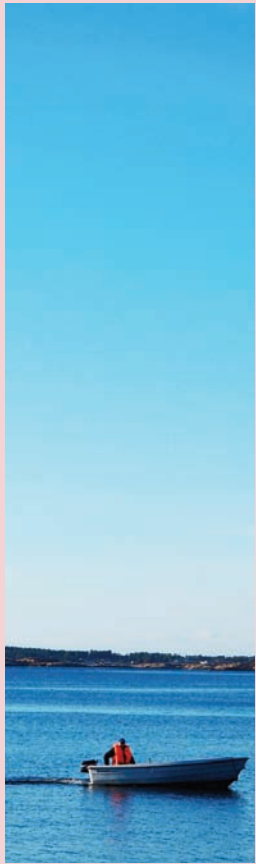
CONCLUSION

North Bohuslän has a strong cultural identity especially from the touristic point of view. The local identity awareness is not as strong in all places and could be strengthened by highlighting the unique history as a border region.

AESTHETIC

North Bohuslän has a dramatic and unique landscape that offers stunning views and beautiful details. The many cracks and rock formations after the Ice Age creates a visible ridge along the rugged coast line. The influence of water is also an important feature and appears inland with many small bogs and lakes and along the coast with the Kattegat sea. The dramatic topography with many fault escarpments has a high aesthetic value for the region. This is the only area in Sweden with a dramatic fjord landscape, the same that can be found in Norway.

Bohuslän often appears in literature and music and has inspired many painters.



S

Dramatic, breath-taking and unique landscape

Diverse visual landscape with open-close areas

Coastal line as an important landmark

Improve access to unknown places of aesthetic value by creating viewpoints and paths

Work for a preservation of the high value in the coastal and inland landscape

W

Difficult to access

Aesthetic values are disturbed by the infrastructure which fragments the landscape and cause noise pollution

Increased tourism could affect the area through more littering, visible human impact and noisy boat traffic.

Visual impact of new activities such as wind farms and new settlements

An inconsiderate improvement of access to the landscape can result in a disturbed visual landscape and a loss of values

Reforestation due to abandonment of agricultural land

T

CONCLUSION

The natural unique landscape is a strong aesthetic resource of high value. Except from natural processes the uniqueness also lies in the low human impact which could be threatened with a high migration and tourism.

SYNTHESIS OF INVENTORY AND ANALYSIS

CHALLENGES

CHALLENGES

Method

From the PEBOSCA and SWOT analysis we have extracted the encounters and categorised them under challenges relating to **Nature, Connectivity** and **Economic activities**. We have chosen to focus on the challenges around the E6 road and the challenges in the different municipalities, and have used symbols to show on a map where we found the challenges most present.

Our approach

Our approach is to define the actual challenges out of these complex needs, wishes and interest within the region. To put the challenges down on paper helped us to see the solutions clearly. It also helped and inspired us in reaching and formulating our overall vision.




CHALLENGES RELATING TO NATURE

In this category we have gathered challenges that have a direct impact on the nature or the cultural heritage. This region has a unique environment with a high biodiversity and many historical remnants which are in risk of damage by the strong human impact.

- **CHANGE OF LAND USE**
Decreasing open land and natural reforestation. Loss of important habitats
- **FRAGMENTED LANDSCAPE**
Island effect isolates habitats, leading to damage or loss of species and habitats
- **LACK OF CONSIDERATION REGARDING CULTURAL HERITAGE**
Infrastructure changes leads to damage or loss of cultural heritage
- **NOISE AND TOXIC POLLUTION**
Due to heavy traffic. Affecting important water sources, habitats and human settlements
- **AREAS PRONE TO SEA LEVEL RISE AND FLOODING**
Damage infrastructure and brings pollutants to nature and water bodies

CHALLENGES RELATING TO CONNECTIVITY

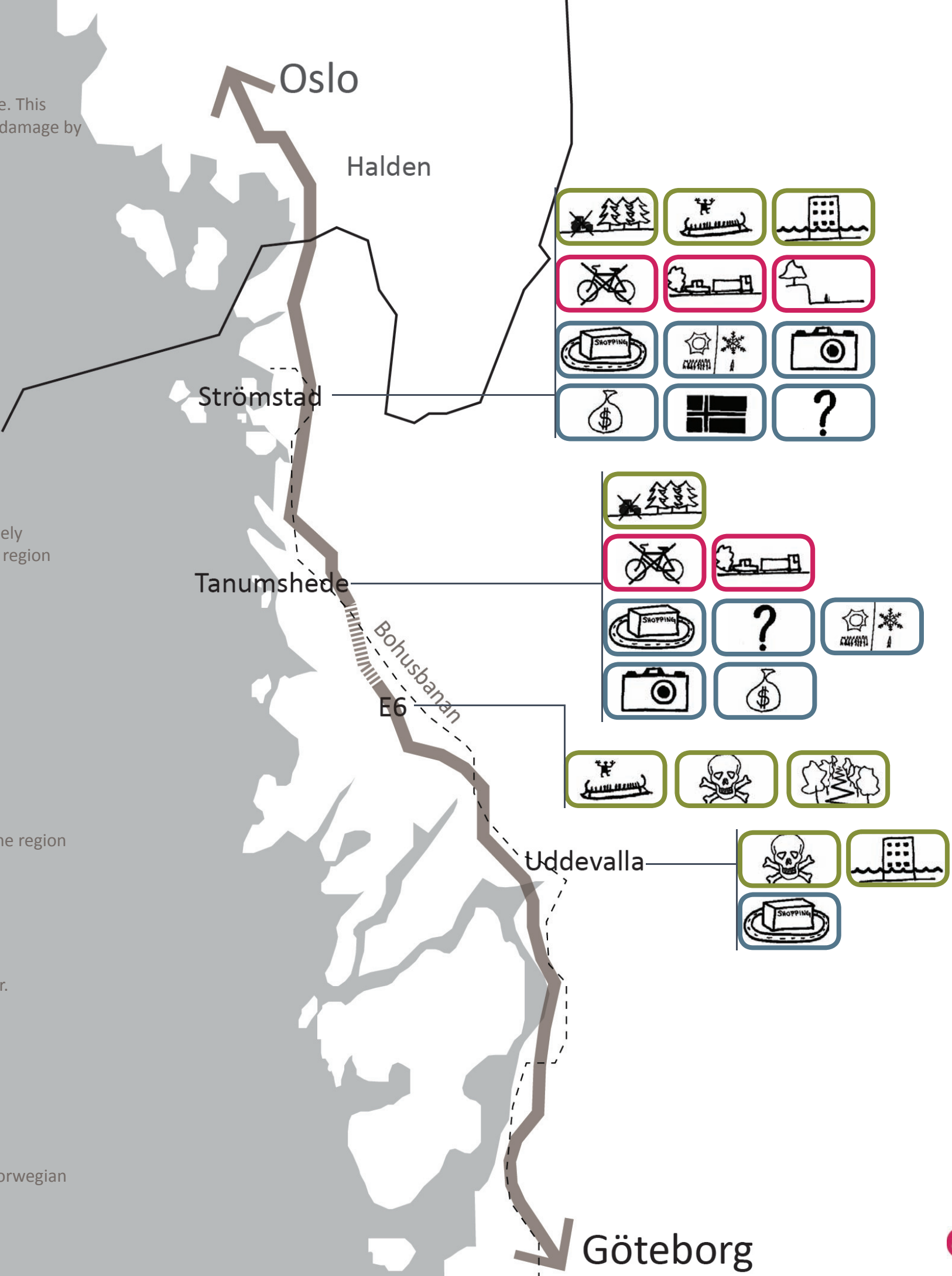
In this category we have listed challenges in the connectivity of the region. Many parts of the area are sparsely populated and the seasonal fluctuation puts high demands on the transport system during summer but the region sometimes lacks public transport in the local level.

- **TRAFFIC INFRASTRUCTURE NOT MEETING DEMAND**
Poor conditions for the demanded speed and the amount of cars result in traffic stocking.
- **UNSAFE/ NON-EXISTING PUBLIC TRANSPORT AND BIKE PATHS**
Increase the car dependence in the region affecting health of human and nature
- **INACCESSIBLE NATURE**
The strong topography in the region is a big challenge in making the area accessible.

CHALLENGES RELATING TO ECONOMIC ACTIVITIES

In this category we have listed challenges that occur because of the low diversity of economic activities in the region where most focus lies on tourism and commerce.

- **EXTERNAL COMMERCE**
Result in dying city cores and car dependent development.
- **SEASONAL POPULATION FLUCTUATION**
Difference in social atmosphere. Tax revenue does not reflect population through out the year.
- **HIGH VALUED TOURISM INDUSTRY**
Tourist needs are prioritised over local needs.
- **DEPENDANCE ON ONLY TWO INDUSTRIES**
Commerce and tourism. Weakens the functional region.
- **HIGH NORWEGIAN INFLUENCE**
Their purchasing power and social influence leave the region vulnerable and dependent on norwegian activity.
- **LOSS OF IDENTITY**
Going from a fishing region to mainly tourism.



CHALLENGES CLUSTERS IN THE REGION

E6



The E6 has strengthened the connectivity in the region but it also promotes a car-dependent development. The road demands a lot of land and is fragmenting the landscape. The high amount of cars that travels on the road offers opportunities for development like external shopping malls outside the city cores. The traffic is also a challenge for the nature and the cultural remnants with the pollutants that it produces.

STRÖMSTAD



Strömstad is highly affected by the seasonal fluctuation of population and the economy is dependent on the tourism and on the norwegian purchasing power. The dependence on very few incomes makes the area vulnerable to changes and the high Norwegian krone is essential for Strömstad municipality. It also makes it hard for the municipality to keep services alive all year around and the permanent inhabitants get less attention in new development. The infrastructure in the area has to meet the needs of the high populated place during summer even though few permanent inhabitants (tax payers) can support this. The high Norwegian purchasing power makes external shopping malls attractive in the municipality. In Strömstad there are already two shopping malls close to the Norwegian border and there are plans on establishing one more and extend the already existing ones. The shopping malls are social hotspots that attract many people but also demand infrastructure that fragment the landscape. It is also a risk for dying city cores when focus lies on external shopping malls. Due to the dramatic topography in the area most of the infrastructure is placed in the lowlands where it has been easier to build even though these areas have been prone to flooding.

TANUMSHUDE



Tanumshede, like Strömstad, is highly affected of the seasonal fluctuation of people and all the challenges that come from that. A part of Tanumshede has been named a World Heritage Site which provides opportunities for the area where the identity could be strengthened by historical values. It is also a challenge for the municipality to consider the World Heritage in their new development plans. Tanumshede is also affected by the Norwegians high purchasing power where a lot of focus lies on tourism and plans on establishment of an external shopping mall close to the E6.

UDDEVALLA



Uddevalla municipality has more inhabitants than Tanumshede and Strömstad and is not as dependent of the Norwegian purchasing power or as affected by the seasonal fluctuation of people as the other municipalities in the region. Even so, Uddevalla has also an external shopping mall and high tourism along the coast during summer time. Uddevalla also has other industries and many main offices for bigger companies that make their economy stronger and less vulnerable. Uddevalla is located in a lowland and the industrial sites are placed close to the water and are therefore prone to flooding. The industrial sites are highly polluted and when flooded the risk for pollutants to leak out to the sea is high. Other than that, most of Uddevalla is expected to lay under water in the future due to sea level rise.



Uddevalla is prone to flooding due to its location in the lowland close to the sea
Picture source: R. Nilsson/P4 Väst



Traffic stockings along E6 adjacent to Strömstad
Picture source: Alexander

PROPOSAL

OUR VISION

STRATEGIES

OUR VISION

MAIN GOALS

STRATEGIES

Method

From our inventory, analysis and from the challenges we found in the region we have summarized what, we think, are the most interesting aspects to work with to strengthen the region as a whole. We have agreed upon a vision for the region and specified three main goals in order to reach our vision. These three goals are then supported by our strategies.

Our approach

By having a vision for the region as a whole it is easier to find solutions even in small scales. The vision for this regional scale will follow us throughout the work down to the fine scale projects. Our aim is, by our proposals in the smaller scales, to show examples of how we could work with the different parts of the region to achieve the vision for the whole region.

*“OUR VISION IS TO STRENGTHEN THE FUNCTIONAL REGION TO SUSTAIN
FUTURE CHANGES. TO GET THERE WE NEED TO ENHANCE LOCAL
QUALITIES IN EACH MUNICIPALITY AND STRENGTHEN THE COOPERATION
IN THE REGION. LOCAL NATURE QUALITIES ARE ESSENTIAL WHEN
IMPROVING LOCAL RECOGNITION.”*

STRATEGIES

We have proposed four strategies that would help us reach the vision and that could be applied in different scales when working in the region.



BROADEN SERVICE DIVERSITY ALL YEAR AROUND

Contributes to a lively city core and focus on local needs



As previously mentioned the functional region means that by having different focus in each area, a broader and more functional region can be achieved. Each municipality should work to find its own identity and focus areas. By a strong collaboration between the municipalities they could together offer a strong and thriving place for permanent and part-time inhabitants as well as for tourists. We believe that this would increase the number of inhabitants who live permanently in the region and therefore a broader market and more services all year around could be established.



EXTENDING PUBLIC TRANSPORT AND BIKE PATHS

Remove pressure on road network, safer transportation by bike and guidance to nature values



For the functional region to work well it is important to shorten the commuting time and provide a variety in transport modes. It should be easy for people to travel for work, recreation, sports or other activities in the region without the requirement to use the car. We believe in a strong green transport network where the focus lies on pedestrians and bikers as well as on commuting traffic such as busses, trains or ferries. By a safe and well designed bike and pedestrian network we would encourage people to use transportation that would strengthen their physical health and lessen the impact on nature.



IMPROVE WATER QUALITY

By using rain gardens, sedimentation basins and swales to reduce pollutants in waterways and allow water fluctuation.

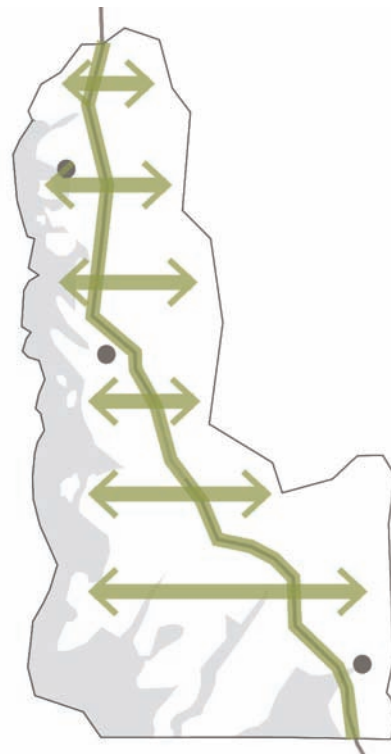


The E6 is a big generator of pollutants and it is important to prevent polluted water from the road to reach sensitive habitats and water bodies in the surrounding landscape. This can be done by using swales along the E6 and also construct wetlands in more sensitive areas with a higher pressure on their waterways. With global climate changes there will be more rainfall in this area so stormwater management is an important issue that needs to be dealt with. Another issue is the sea level rise that can become extra problematic in Uddevalla harbour where all the polluted soils need to be secured.



LESSEN THE BARRIER EFFECT

Constructing ecoducts, tunnels to reconnect habitats and noise barriers to prevent noise pollution



With new infrastructure such as the E6 road and shopping malls with large paved areas a lot of fragmentation and pollutants disturb the habitats in the region. We think it is important to work reconnecting the habitats and to minimize the negative effects of the human impact. We also think it is important to make the nature available for people. By designing informative paths in the nature we would increase the awareness of the surroundings which hopefully would result in a greater consideration towards the nature in the every day life.

CHALLENGE CLUSTERS

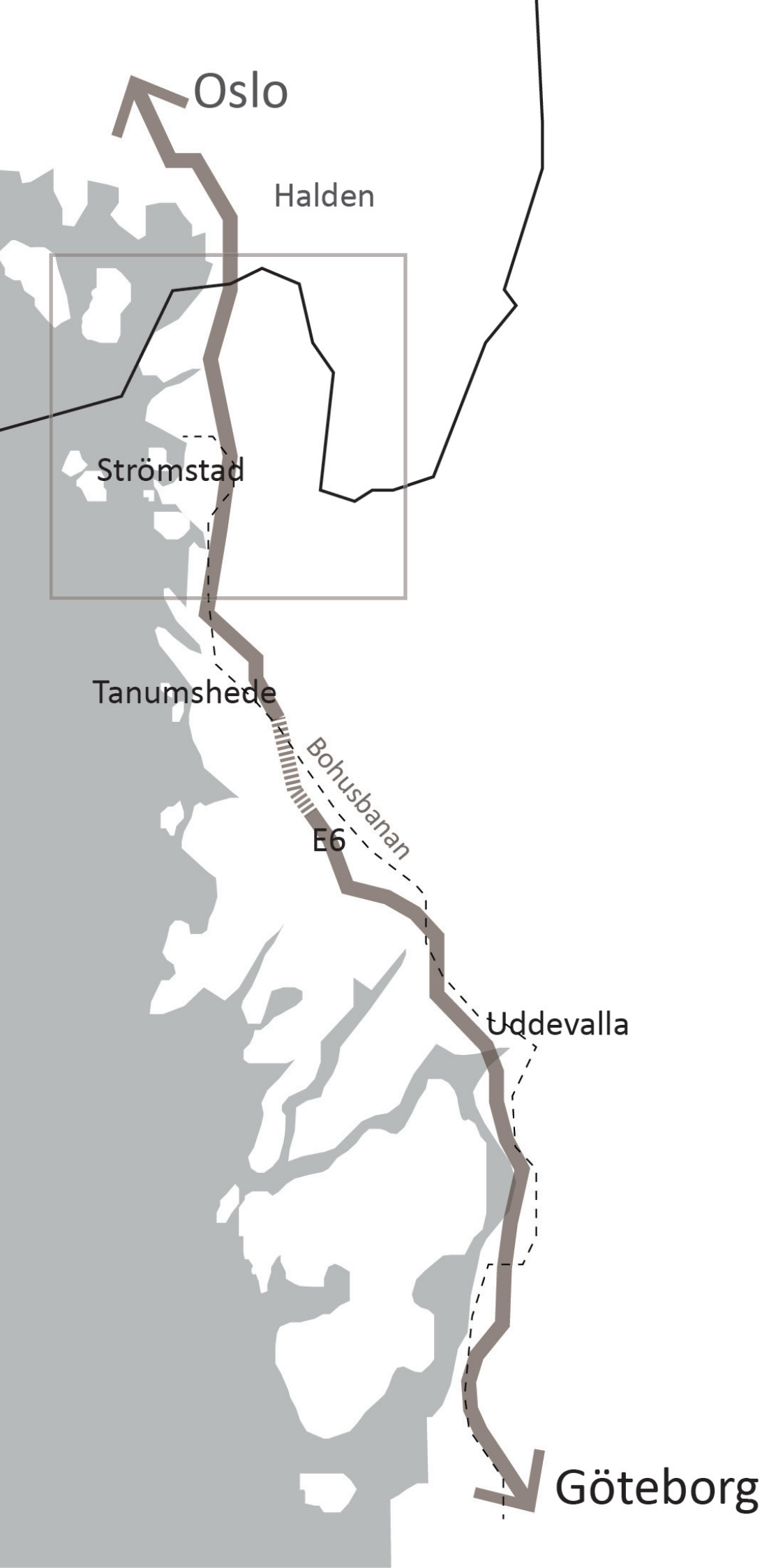
CHOICE OF SECOND SCALE

Method

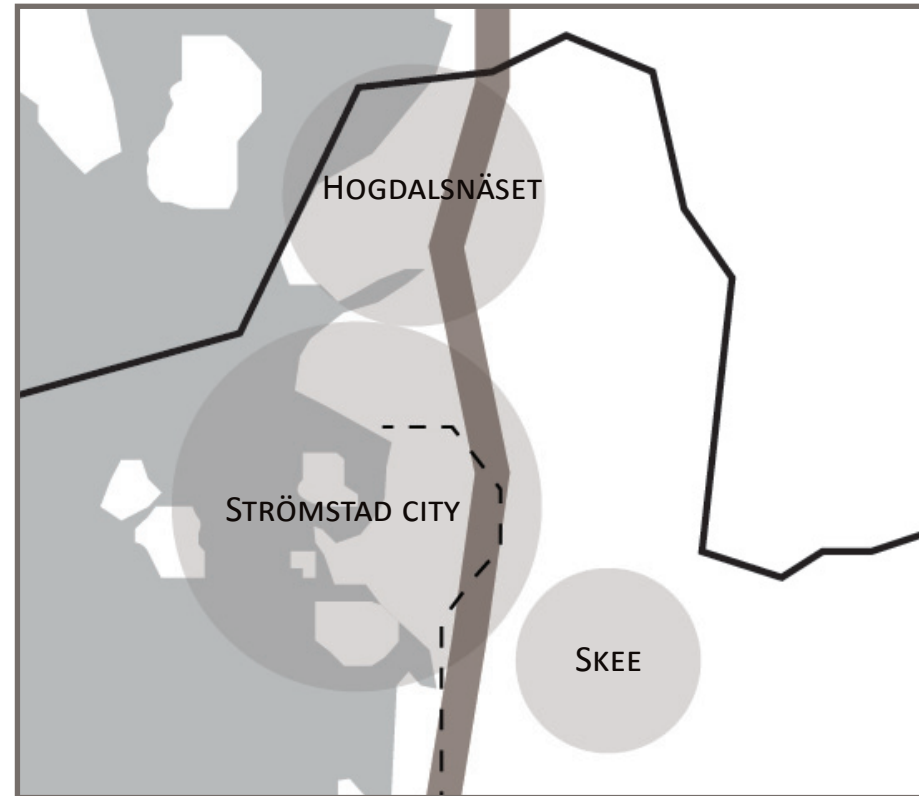
In order to decide how to move on with our further studies we have analysed the different areas and the challenges to find the area holding the highest complexity of challenges.

Our approach

By choosing an area that contains many of the challenges defined, we hope to be able to show an example of how our vision and our design strategies can be used for further development in the region. As well, we want to direct our solutions and further studies to an influential area so that we will be able to produce a larger effect on the region as a whole.



CHALLENGE CLUSTERS WITHIN STRÖMSTAD MUNICIPALITY



As seen in the previous description of all the challenges in the region, many of them have a strong presence within Strömstad municipality. For our further studies we have chosen to divide Strömstad municipality in three main areas: Skee, Strömstad city and Hogdalsnäset to narrow it down further.

HOGDALSNÄSET

Hogdalsnäset is located north of Strömstad, close to the Norwegian border and is therefore heavily influenced by the Norwegian activity and seasonal economical flows. The area is sparsely populated but the two shopping malls in the area are attracting many people, mostly Norwegians. Traffic jams occurs frequently on the E6, going through the area on smaller roads to Nordby shopping mall. The E6 and the external shopping malls are defining the area and the heterogeneous nature with many historical remains are given less focus. The infrastructure is located in the lowlands and it is prone to flooding.



STRÖMSTAD CITY

Strömstad is the “capital” of the municipality and here most of the all-year-around services can be found. Strömstad is highly affected by the seasonal fluctuation and many services and other functions are closed during low season.



SKEE

Skee is a small settlement south of Strömstad. The area offers a few services all-year-around and are less affected by the tourism than Strömstad and Hogdalsnäset. Skee sees themselves as an important entrance point to Strömstad municipality. West of Skee goes the E6 road. The road has been prone to flooding which is a challenge in the region as well as the lack of access to the nature and the car focused transport system.



CHOICE OF AREA

HOGDALSNÄSET 13 CHALLENGES
STRÖMSTAD 6 CHALLENGES
SKEE 8 CHALLENGES

Apart from the number of challenges the complexity and the possible solutions within the area has guided us in the choice of study area for the 3rd scale.

We have chosen **Hogdalsnäset** for further studies because most of our analysis point at Hogdalsnäset as a complex area with high influence. What distinguish Hogdalsnäset from Strömstad and Skee is the lack of a town centre. Hogdalsnäset is affecting the region as a whole and is an important platform when it comes to receiving our visionary goals explained in the previous chapter.

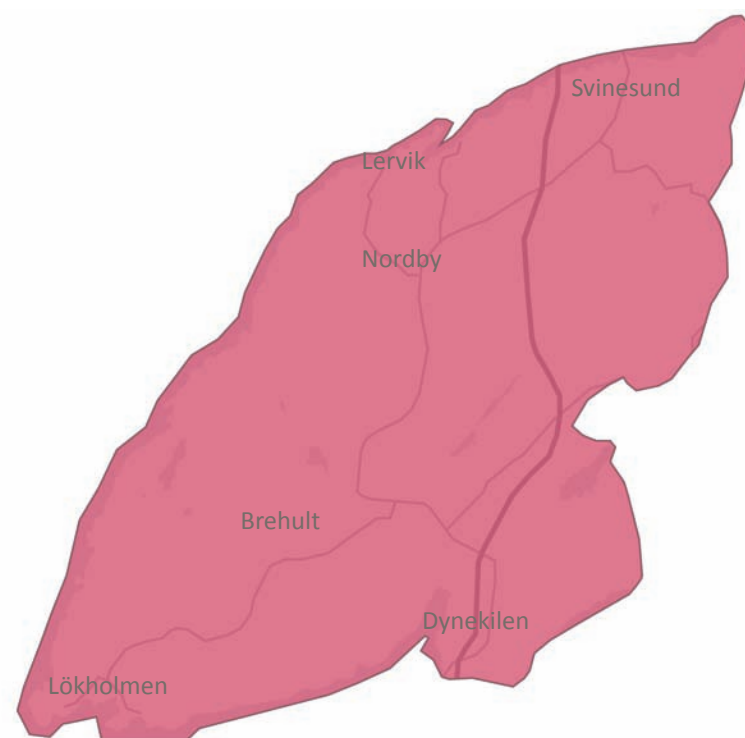
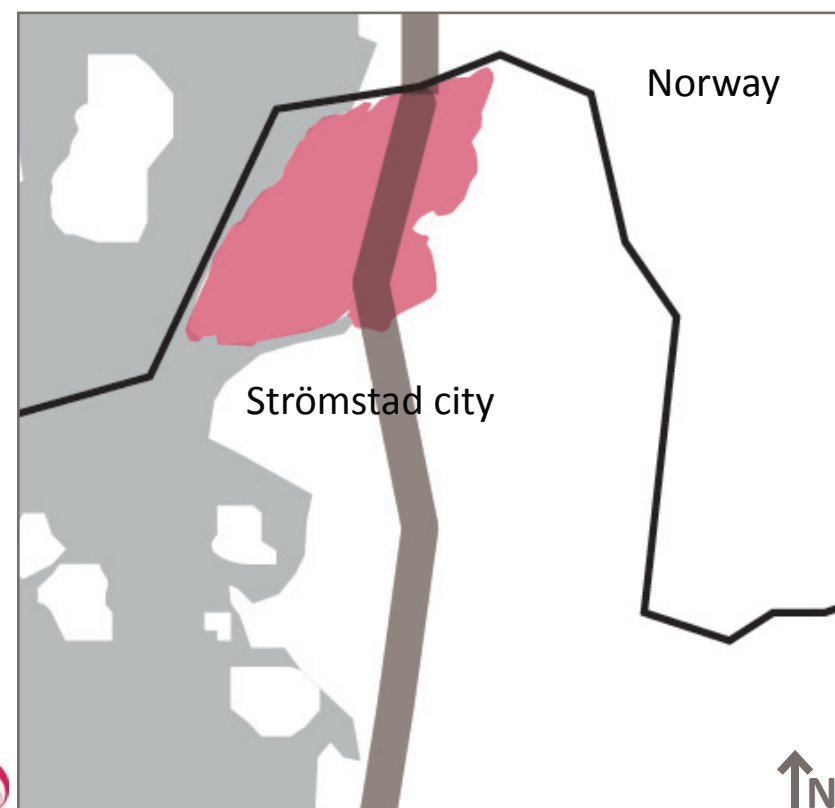
SECOND SCALE

HOGDALSNÄSET

In this second scale we are focusing on Hogdalsnäset. The chapter has the same structure as the first scale, but here we are looking in detail this particular area. The chapter ends with a description of how we apply the vision for the entire region in this area and how we move further down to the fine scale proposals.



HOGDALSNÄSET



We believe that Hogdalsnäset is a good example of a border region with high influence from the neighbouring country. The high Norwegian purchasing power together with E6 as a large infrastructure drives Strömstad municipality into development supporting car dependency with negative social and natural effects to follow.

We see an opportunity in redirecting the area towards a more resilient development where design strategies bring out the positive strengths within the area and prepare the area for future changes.

We wish our solution to serve as a component in achieving a resilient development of North Bohuslän and Strömstad municipality. We also wish to show examples of how to handle the challenge with strong market forces, external commerce, loss of identity, car dependance and the future role of urban-rural areas.

Our choice of framing for the inventory and analysis is based on the first scale LCA. Hogdalsnäset is, in the LCA, described as a Coastal Forest and distinguishes itself from the higher forest in the east and the barren coastal lowland in the north.

INVENTORY

LAYERS IN THE LANDSCAPE

LAYERS IN THE LANDSCAPE

Method

To get a deeper understanding of the area we have chosen to study the different layers of the landscape separately. The layers we are studying are; Land use, Nature, Connectivity, History, Culture, and Social. We have mainly based the information on the municipalities documents and the interviews we have done on site.

Our approach

Our main focus for this inventory has been to gather the most important information needed for further studies. We have done this from a holistic point of view where the different layers in the landscape are in focus. This formed a foundation that helped us in our further analysis of Hogdalsnäset.



Agricultural land shows open spaces



Clear cut in Brehult



Inland forest



Agriculture at Hogdalsbäcken stream banks



Lökholmen campsite



Harbour at Kungsvik



LAND USE MAP

LAND USE

Current land use contributes to the characteristic open-landscape picture. In general lines it can be divided in four main different uses: Agriculture, forestry, recreation and industry.

AGRICULTURE

Placed over soils composed by silt and clay. This use is diverse and small-scale. Its extension is reduced to depressed patches and the Hogdalsbäcken stream banks. Agriculture is mainly found as patches of non-irrigated arable land but also as heterogeneous patches with complex cultivation patterns (EEA nd). The agricultural landscape around Nordby and Medby accommodates valuable farmland (Strömstad kommun 2003).

FORESTRY

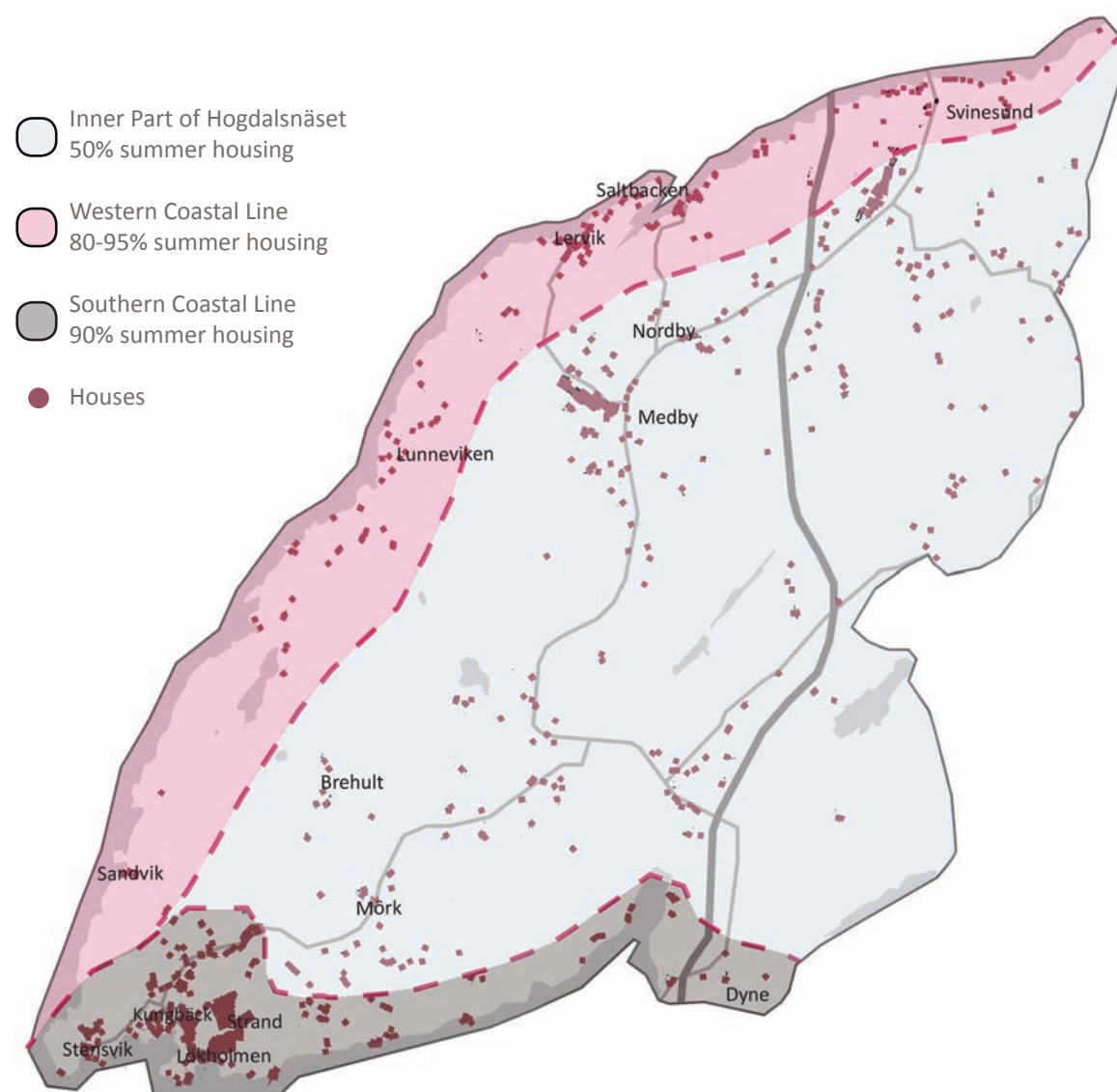
Forest dominates the area and are mainly integrated by coniferous forest with some birch and aspen. The forest is a source for both lumber, fuel, hunting, recreation, berry- and mushroom picking. The forest are mainly placed on outcrop land covered with thin vegetation and sparse pine forest. Outcrop expansion increases as we approach Idefjorden and in the mountains. Forestry is an important activity at Hogdalsnäset as forests are a large-scale feature and many clear cuts can be seen in the area. Due to the topography and the thin soil cover the large scale forestry is restricted. A few patches of mixed forest and broadleaved forest are also of importance for a high biodiversity (Strömstad Kommun 2003).

RECREATION

The area hold a few high valuable sites for recreation as rocky beaches, leisure boat harbours and outdoor sports. Normally the recreational sites face the fjord or the coast and are surrounded by summer houses and camping areas. The great value for active outdoor life lies mainly in the large undisturbed nature with an remote and wild character. Today swimming and boating around Hogdalsnäset is not as extensive because of few natural beaches and places to drop anchor. On the south side of Hogdalsnäset four camping areas are located; Kungsvik, Sågestrand, Lökholmen and Dynekilen camping area close to Dynekilen Golf Club. On the North side of Hogdalsnäset there are two settlements called Saltbacken and Lervik. They are both of national interest for conservation and outdoor recreation (Strömstad Kommun 2003).

INDUSTRY AND COMMERCE

There are two main shopping areas in Hogdalsnäset; Svinesund shopping mall and Nordby shopping mall. Nordby shopping mall is a significant destination point for trade tourists from Norway. Other industrial activities are destined to the discontinued small scaled fish industry. There are two main harbours; Kungsvik and Kålvik. Kungsvik is mainly used for recreational purposes by summer visitors. Kålvik, west of Nordby, have highest standards for net revenue opportunities and depth conditions for various port purposes. It is considered of national interest for deep-water dependent activities. Kålvik produced in 1970's an oil platform and the area still show traces of activities such as storage areas, quays and road system. Kålvik will, with a further expansion of the interchange at Nordby, be at a good location close to transportation (Strömstad Kommun 2003).



HOUSING

Generally Strömstad is an attractive place to live and the municipality have a big queue to new housing because of the housing shortage. The lack of housing means that the amounts of tenants is much less than it potentially could be (Strömstad kommun nd). A big problem in the coastal region is the high attraction for part time housing which means that permanent residents can't cope with the prices (Strömstad kommun nd). The conversion of permanent housing to cottages are something the municipality can't control and feel like they have big planning challenges to cope with in the future when it comes to schooling and home care services (Strömstad kommun nd). Hogdalsnäset is a sparsely populated area with no main settlement and the number of households in the area are only 384. Out of these there are 189 permanent households and 186 summer households (Dahlberg 2013).

Southern Coastal Line (Stensvik-Kungbäck):

In the south coast between 80 to 95% of the houses are summer houses¹. Stensvik in the west, consists of large houses used all year around mixed with summer houses; Kungsvik and Sågestrand have no permanent housing but campgrounds situated close to the shore; Strand, located in the mountain northeast of Lökholmen, contains several summer housing; and Lökholmen, consists of a camping area and some residential houses.

Inner Part of Hogdalsnäset:

In Hogdalsnäset approximately 50% of the houses are summer houses¹. It is a sparsely populated landscape. The buildings are mostly located at the edges of small valleys in the southeast part and around Nordby.

Western Coastal Line (Lunnevik-Saltbacken):

In the west coast more than 90% of the houses are summer houses¹. The settlements are situated at Lunnevik, Kålvik, Lervik which is planned to become a natural reserve, and Saltbacken.

¹ Björn Richardsson overview planner Strömstad municipality, email the 8th of November 2013.



Dynekilen campsite



Permanent housing



Part-time housing

CONCLUSION LAND USE

The region has two main industries; forestry and tourism. The tourism is focused along the coast and the most intensive forestry can be found inland. In the rift valley small scale agriculture is located. The two shopping malls; Svinesund and Nordby, attracts many people to the region and take a large land area in possession.



OUTCROPS SHOWN IN GREY ON ORTHOPHOTO

NATURE

In the in depth masterplan for Hogdalsnäset Strömstad municipality describes the landscape in four different types: **Agricultural land, forested land, rocky landscape and coastal area.** The **agricultural land** is described as varied with agricultural land framed by smaller hills and rocks. The **forested area** is of a rather big scale where the lower parts are covered by coniferous forest with some birches *Betula pendula* and aspen trees *Populus tremula*. The **rocky landscape** consists of outcrops which are bare or covered with a thin layer of vegetation and sparse pine forest (Strömstad kommun 2003). The terrain in the rocky landscape has a dramatic topography with steep cliffs and wide outlooks towards the sea and the fjord. The **coastal area** is dominated by steep rocky shores. The steep and inaccessible coast is unique features in the varied landscape (Strömstad kommun 2003).



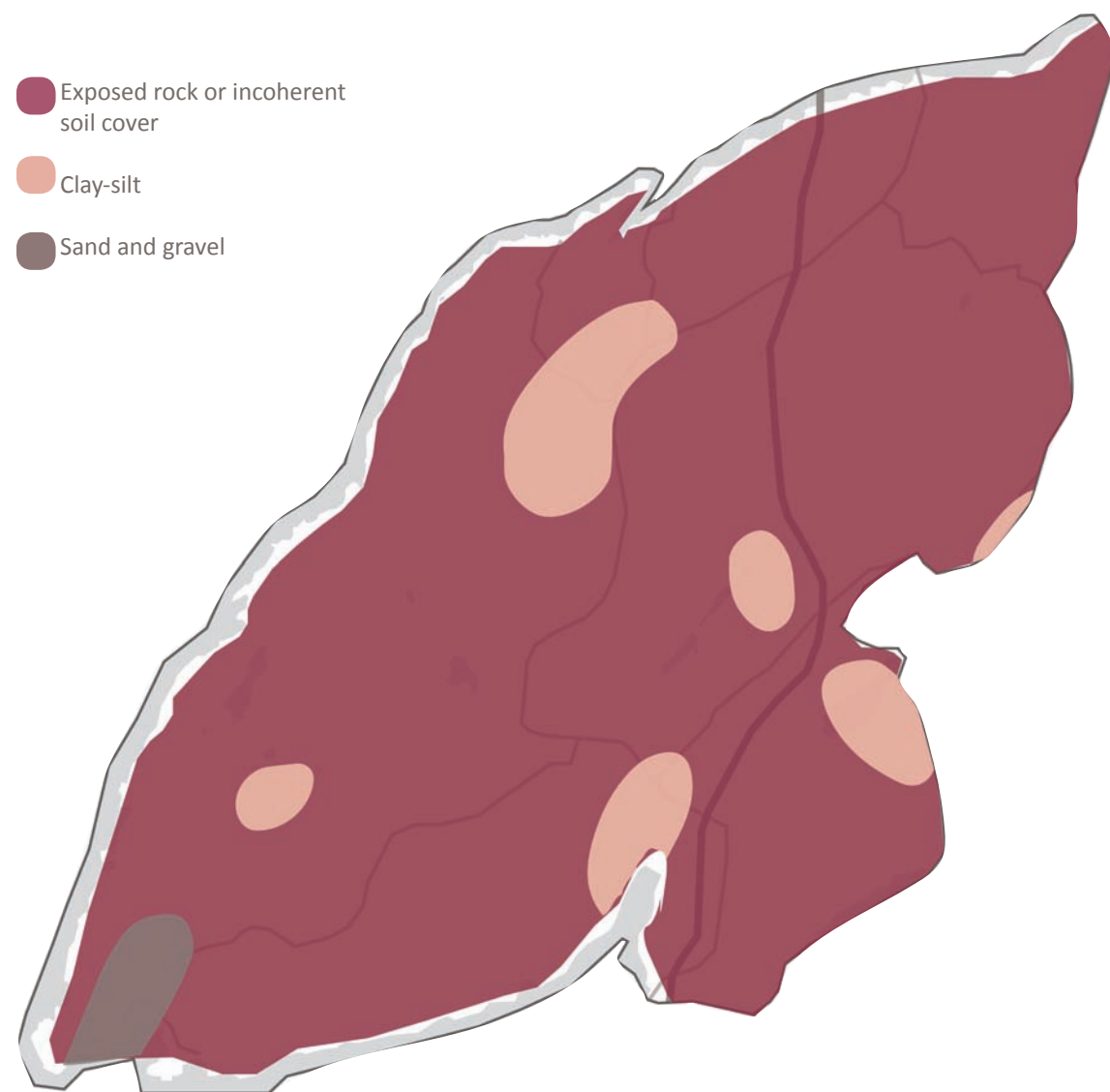
Coastal area

The municipality's goal is to harmonize and balance the various interests in the area where recreational areas are important as well as "untouched" nature, and a rich biodiversity should be pursued. It is crucial for the characteristic open landscape and for the biodiversity that the agricultural use is ongoing so that the land is not reforested. The continuous forest are important for forestry, but also for the varied outdoor activities and recreation as well as the biodiversity. The forested land should, as far as possible, be protected from activities that prevent forestry according to Strömstad municipality. The municipality also believes that a consideration to nature conservation values should be taken so that they are not damaged (Strömstad kommun 2003).

In the following pages we will describe the soil and the protected nature followed by areas of high value for biodiversity. We will also describe shortly the water bodies in the area.



Rocky forest with thin vegetation and sparse pine forest

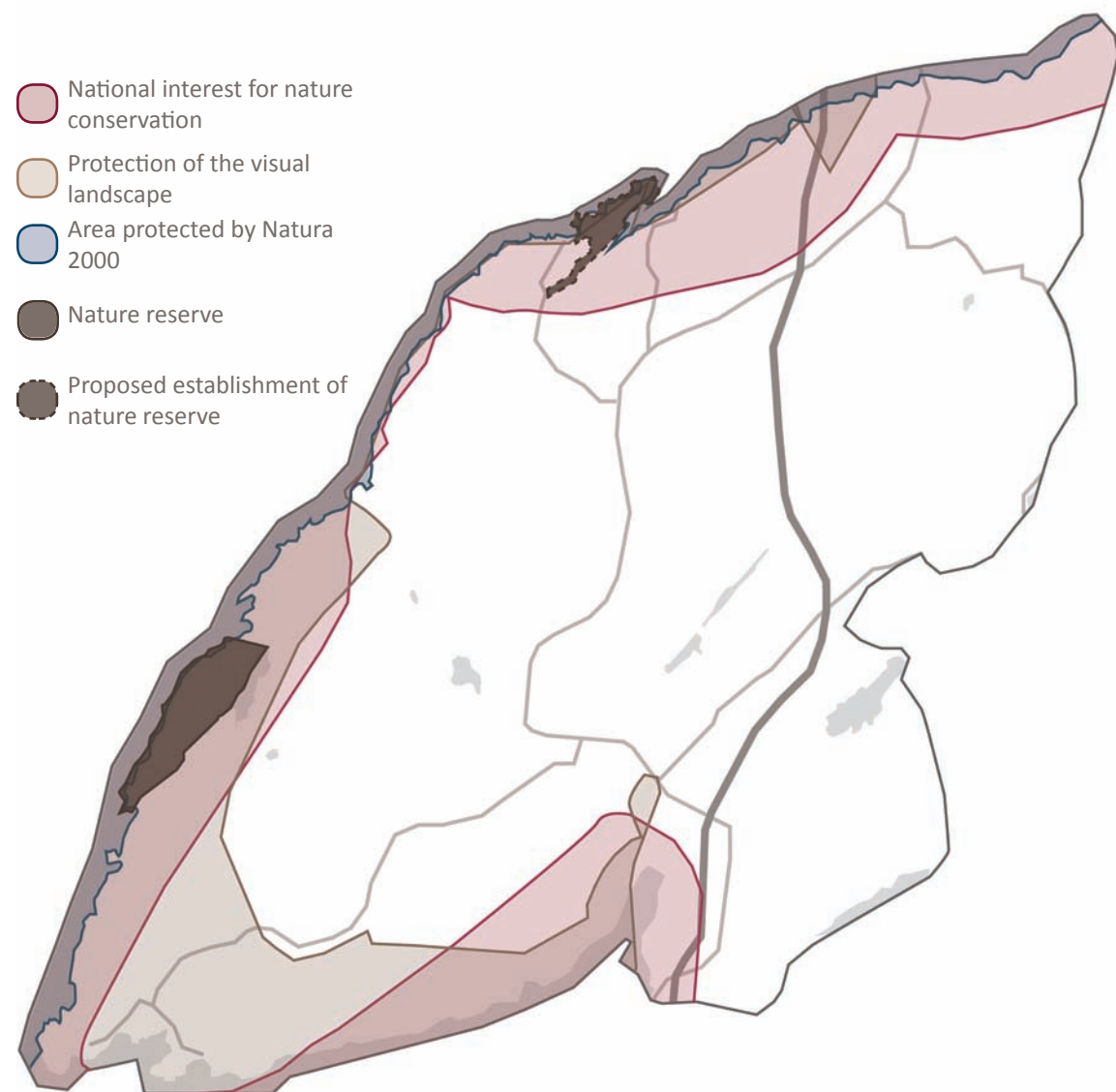


BASIC SOIL CONDITIONS

SOIL

The area presents a very homogenous geology pattern with a lithology of granite and pegmatite. The main soil type is exposed rock or incoherent soil cover. It forms a matrix that contains the other soil types. Secondly, there are some scattered patches of clay and silt, located in valleys or lowlands like Nordby, and at the sedimentation stretch of Kungsbäcken stream. There is also an isolated patch, placed at the westernmost part of Hogdalsnäset, of sand and gravel.





AREAS COVERED BY PROTECTIONS

PROTECTED NATURE

The areas with protected nature are located along the coast and contain **National interest for nature conservation, Natura 2000, Protection for the visual landscape and nature reserves.**

NATURA 2000

Natura 2000 is an “ecological network” that is built up by the members of EU with the aim of preserving the European plant and animal life. The primary conservation objective in this area is to preserve the different marine habitat types. The area has an unique marine environment, which provides livelihood for a very special and rich fauna and flora (Länsstyrelsen Västra Götalands län 2011).

NATIONAL INTEREST FOR NATURE CONSERVATION

National interest for nature conservation is regulated in Miljöbalken. The area must be protected against measures that could damage its values. The most important value in this area is the unique marine habitat which includes threatened species unique for Sweden (Strömstad kommun 2008).

PROTECTION OF THE VISUAL LANDSCAPE

The protection of the visual landscape is used to maintain the visual aspects of the area, characterized by the particular nature and the beautiful landscape (Strömstad kommun 2008).



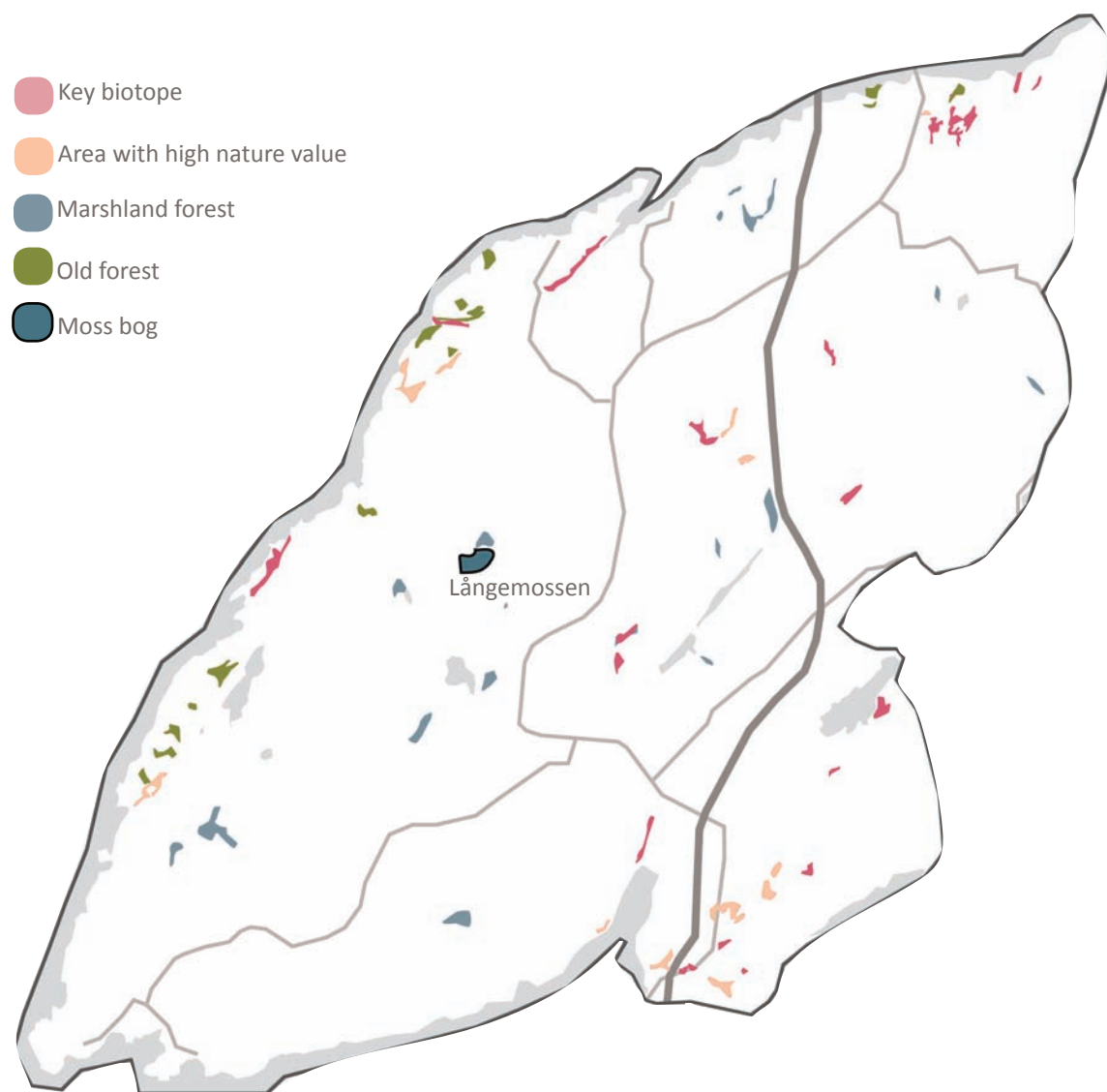
Vagnsjön in Halle-Vagnaren nature reserv

NATURE RESERVE

Today there is one Nature Reserve in the area, Halle-Vagnaren which was founded in 2005. Halle-Vagnaren is characterized by its very old pineforest with primeval character. Pines *Pinus sylvestris* and spurs *Picea abies* more than 300 years old are found in the area, and the trees are clearly affected by the salt and the wind (Länsstyrelsen ND). The municipality is also proposing an establishment of a new nature reserve around Kobbungsbäcken. The area is of great importance for nature conservation but also for the local outdoor recreation. Kobbungsbäcken and its river mouth have known fish biological values. The nature is relatively untouched and the forest has been there a long time. Kobbungsbäcken is also of high botanical and ornithological interest (Strömstad kommun 2008).



Halle-Vagnararen nature reserve



AREAS WITH SPECIFIC NATURE VALUE

AREAS WITH HIGH NATURE VALUES

Within the forested area there are patches of high valued nature where **key biotopes**, **marshland forest**, **old forest** and one **moss bog** can be found.

KEY BIOTOPES

A key biotope is a habitat that play a crucial role in the forest's endangered flora and fauna. According to Skogsstyrelsen a key biotope is a quality concept that refers to forested areas where red-listed species are expected to be found. The classification means no automatic protection for the area but works as a kind of basis for a possible future form of protection. In connection with the inventory for key biotopes a number of "areas with high nature values" also have been registered. These areas can in time develop into valuable key biotopes (Strömstad kommun 2008). Most of the key biotopes in the area are classified as what we in Sweden call "Ädellövskog" which is forest with selected valuable deciduous broad leaf trees such as oaks *Quercus robur*, elms *Ulmus glabra*, ashes *Fraxinus excelsior*, maples *Acer platanoides*, linden *Tilia cordata* and hornbeam *Carpinus betulus*. A few streams and ravines are also found among the key biotopes.



Dead wood contributes to many species. Source: Tennesseean

MARSHLAND FORESTS

Marshland forest is a collective term for forested wet lands. It is one of the richest natural habitats because it is both forest and wetland. Several of the most endangered species lives in these areas, for example bryophytes, lichens, shells, frogs, flies and beetles. Woodpeckers *Picidae*, Capercaillie *Tetrao urogallus* and Hazel Grouse *Tetrastes bonasia* nest in the Marshland forests (Strömstad kommun 2008).

OLD FOREST

The old forest also has a rich flora and is of high importance for birds and bugs. The old tree forest is rare in Strömstad municipality and are therefore of high importance for protection. In the old forest areas the most common old trees are spurs *Picea abies*, pine trees *Pinus sylvestris* oak *Quercus robur* and linden *Tilia cordata*.

MOSS BOG

One of the regions lowest situated moss bog is located in the area and is called Långemossen. The bog is only slightly arched and the vegetation is dominated by heather *Calluna vulgaris* and crowberry *Empetrum nigrum*. The flora also contains of cloudberry *Rubus chamaemorus*, hare's-tail *Eriophorum vaginatum*, cranberries *Vaccinium oxycoccos* and deergrass *Trichophorum cespitosum* (Strömstad kommun 2008).



In the area several patches with old forest can be found



WATER BODIES

HYDROLOGY

Many **streams** and **wetlands** as well as smaller **lakes** are found in the area, all contributing to a rich biodiversity and ecosystem services. Northwest of Hogdalsnäset runs **Idefjorden**, forming the border between Sweden and Norway.

IDEFJORDEN

Idefjorden is, for Sweden, a unique threshold fjord that contains many marine habitats. For Halden Idefjorden is one of many threshold fjords and they wish to remove the threshold from Idefjorden to bring large boats to the paper industry located upstreams. Sweden on the other hand sees the threshold as unique and important to keep for its nature values ².

LAKES

The lakes in the area are located in rift valleys and are surrounded by hilly terrain and steep cliffs. The lakes contain fish such as perch, pike, roach and eels. The lakes in Strömstad municipality has been affected by acidification, which the municipality partially solved with liming (Strömstad kommun 2008).

WETLANDS

In the wetlands there are a series of processes that all contribute to improved water quality. The environment in and around the wetlands offers a special habitat for flora and fauna. It is therefore of utmost importance to preserve the wetlands in the area (Strömstad kommun 2008).



STREAMS

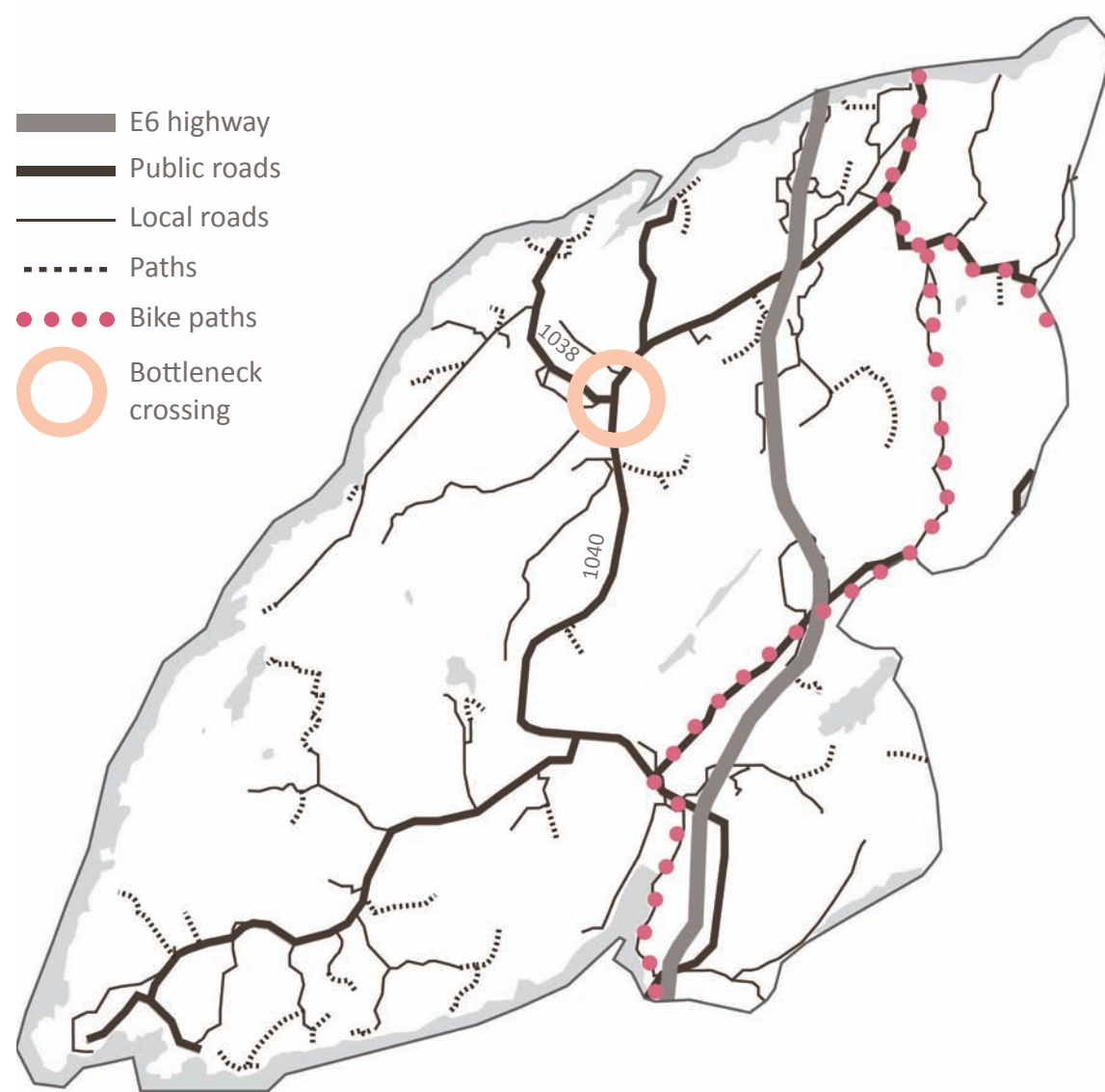
The streams are also of high importance for the biological life in the area. All streams that do not dry out during the summer provide habitat for fishes like trout, eel, stickleback, minnow dace and brook trout. In the streams some red-listed species such as the two mussels, *Margaritifera margaritifera* and *Anodonta anatina* also can be found. A few streams and the lake Vagnsjön are of regional interest for fishing, these streams serve as spawning grounds for trouts (Strömstad kommun 2008).

In Hogdalsnäset Kobbungebäcken is of high ecological value. Kobbungebäcken has a large catchment area that includes two external shopping malls. The stream runs under Nordby shopping mall in a culvert. In fall 2011 the culvert was flooded and much of the shopping mall was hit by flooding. Even at Svinesund external shopping mall there are problems with water flow during heavy rainfalls. The large paved and heavily trafficked areas adjacent to the shopping malls mean that polluted stormwater flows into Kobbungebäcken (WSP 2012).

² Espen Sørås overview planner at Halden municipality, interview the 17th of October 2013.

CONCLUSION NATURE

A varied landscape with a dramatic topography contributes to rich biodiversity but makes the area hard to access. The unique coastline and the marine habitats are of high importance in our area and are covered by different kind of protections, covering both the habitats and the visual landscape. The coastline is rather unexploited compared to other stretches of the Bohuslän coast. Also in the inland there are many important nature values such as water bodies, key biotopes and old forest that are all sensitive to development.



ROAD AND PATH NETWORK

CONNECTIVITY

The road infrastructure in Hogdalsnåset has a main direction from south Strömstad to the northern Halden and further on Oslo.

ROADS

The new E6 is used by heavy traffic and commuters on a daily basis. Strömstad municipality has calculated the instantaneous traffic through the new toll station to be 12 500 vehicles per day in comparison to 6 500 on the old bridge. The old E6, now called road 1040, goes west of the new road and is mainly used as a local road to access Nordby shopping mall or smaller private roads. The road network along the coast is planned for development in order to expand the tourism. According to Strömstad municipality the infrastructure also needs to support other transportation modes than cars. The inland around the new E6 has poor accessibility and the road network is sparse and of low standard. Many of the large forest areas can only be reached by foot. Around public holidays or during the summer months the traffic at the bottleneck crossing, which is pointed out on the map, is intense with traffic stockings to follow. The municipality is now planning for a reconstruction of the crossing which also takes in consideration the possible future expansion of Nordby shopping mall (Strömstad kommun 2003).



E6 on a bridge contributes to noise pollution but spares the nature underneath

PATHS AND BIKE LINES

Many of the smaller paths are tractor roads used for forestry or private roads going to farms and houses. The area lacks public paths and roads to access forest and water for recreational purposes. The only planned bike path in the area is part of a 44 km long loop trail called 'Kulturrundan', Cultural trail. As can be seen on the map the culture trail goes from Strömstad inland up to Hogdal and then out to north-east Idefjorden (Strömstad infocenter nd). According to the municipality, bikes and pedestrians are not allowed to cross the new bridge but are directed to the old Svinesund bridge (Strömstad kommun 2003).

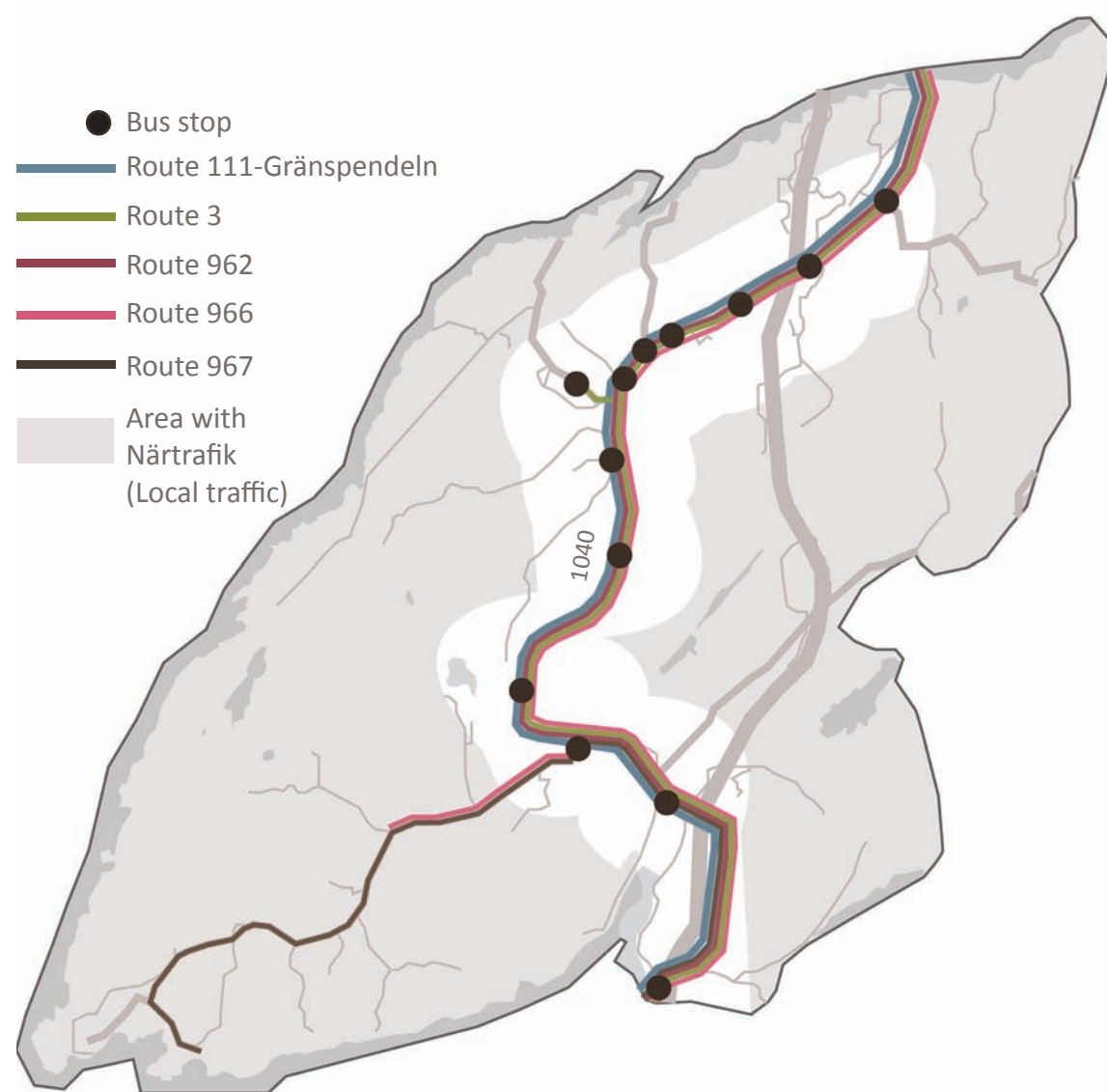


E6 goes through the dramatic rift valley landscape

Source: M. Ignatieva

Many of the private roads are poorly maintained





BUS LINES

PUBLIC TRANSPORT

There are five bus lines passing through the area and two of them are only open for children commuting to and from school. The school busses 962 and 967 leave 2-4 times a weekday (Strömstad kommun nd-c). Buss 111, also called 'Gränspendeln' (The Border commuting line) goes frequently both weekdays and weekends between Strömstad and Halden in Norway. From Halden you can continue by bus up to Oslo (Østfold kollektivtrafikk nd). As can be seen on the map the permanent bus stops are located along road 1040, the old E6, and the distance to a bus stop within the white area on the map is not more than 1 km. People travelling to and from places in the grey area pointed out on the map can't take the frequent bus routes but instead they have the option to book a bus. The grey area on the map is the land covered by Närtrafik, Local traffic, which travels to and from Strömstad city core. The passengers need to book 2 hours ahead and can choose between 6 departures a week (Västtrafik 2013).



Most people access Nordby shopping mall by car. Source: strömstadtidning.se

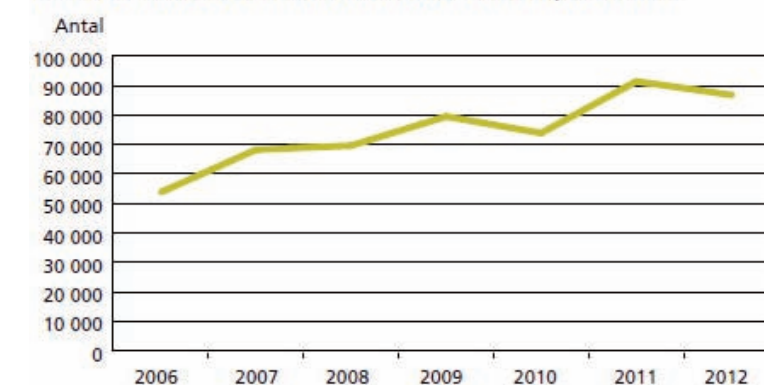


The border commuting line leaves 11 times a day. Source: B.Talbrant



The bike network is more developed on the Norwegian side

RESANDE GRÄNSPENDELN STRÖMSTAD-HALDEN, 2006-2013



The commuters using The Commuting line has increased Source: Vgregion

CONCLUSION CONNECTIVITY

Poorly access with busses to areas over 1 km away from the E6. Bike network almost invisible and only as part of a recreational trail. No bike paths for commuting. Few public roads accessing nature.



HISTORICAL REMNANTS

HISTORY AND CULTURAL LANDSCAPE

The area is part of a larger context in which the area's natural geography and its location between the two countries, Sweden and Norway, are important aspects for development. Strömstad has been inhabited since the earliest Stone Age and seems to have had its glory days in the Iron Age and early Middle Ages. Agriculture and Fishing has been important industries as well as forestry. In the area the human-shaped history with historic remnants and ancient farmlands is visible (Strömstad kommun 2012). The last 50 years a lot has happened with the landscape and the small-scale agriculture that took place in the area have lost its importance. Much of the farmland has been taken out of use and there is a risk that the land will be reforested (Strömstad kommun 2008). In more recent years trading, both the import, export and local market has formed an important basis for Strömstad and its surroundings (Strömstad kommun 2012).

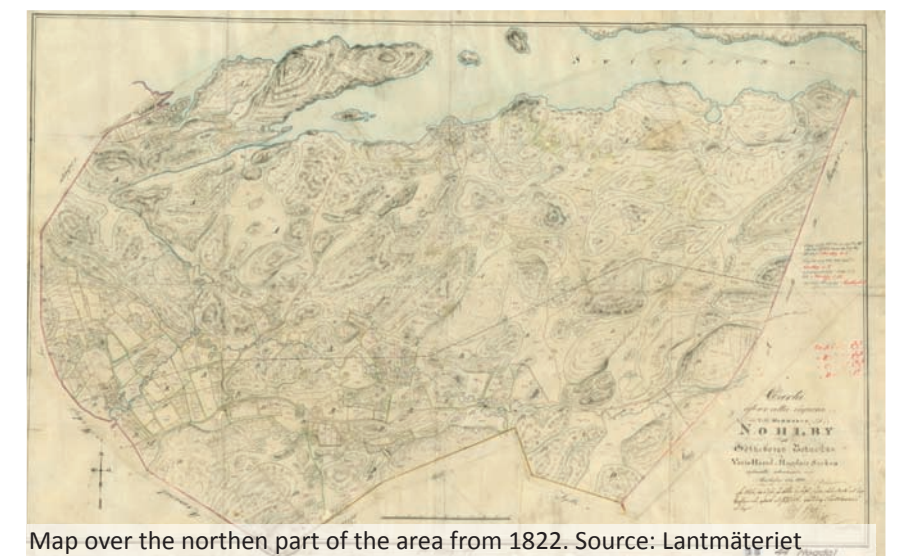
Due to the rich cultural heritage, ranging from fixed monuments to traditional Bohuslän farm environments and fishing villages, substantial consideration is necessary in new development. In order to preserve the area's many cultural values, additional Businesses, buildings and settlements should be planned to fit in and harmonize with the historical environment (Strömstad kommun 2012). The municipality also writes that new buildings and other measures that would help to preserve the open cultural landscape should be considered favorable (Strömstad kommun 2003).



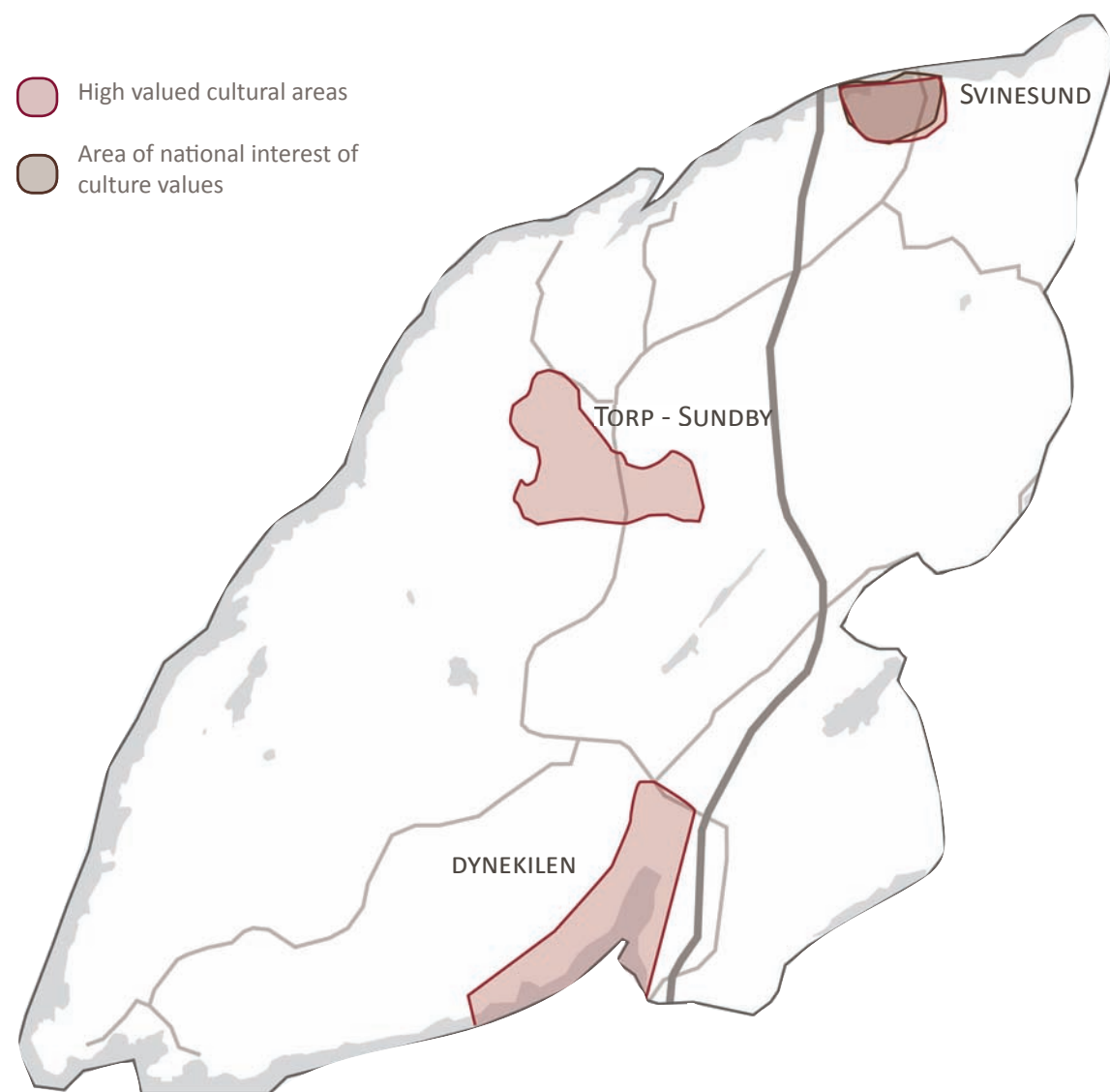
Many rock carvings can be found in the area.

As seen on the map to the left there are many historical remnants in the area. A lot of rock carvings can be found but also remnants of settlements and burial sites as well as old routes. The municipality has pointed out five areas where many important remnants are gathered, these are numbered on the map and described below.

- 1.** Around the Svinesund bridge there is an important border environment with remnants from a fortress, burial sites, settlements and routes.
- 2.** At Torp there is an historic agricultural environment with traces of old settlements, rock carvings and burial sites.
- 3.** South of Sundby has remnants of an ancient burial ground and a settlement.
- 4.** In Mörk there are rock carvings, burial sites and remnants of settlements.
- 5.** In Kungsbäck there are remnants from one settlement and several burial sites in the form of cairns (Riksantikvarieämbetet ND).



Map over the northern part of the area from 1822. Source: Lantmäteriet



AREAS WITH HIGH CULTURAL VALUE

AREAS WITH HIGH CULTURAL VALUE

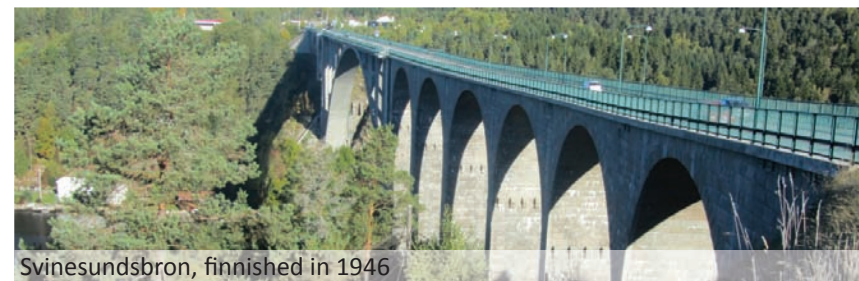
Bohuslän Museum did an inventory of historical sites in 2003 where they pointed out areas with very high importance for culture values. In our area they pointed out three areas, around **Svinesund**, around **Torp and Sundby** and around **Dynekilen** (Strömstad kommun 2012).

SVINESUND

Around Svinesund there is a border environment with great historical significance for communication and war. Ferry camps, bridges and fortifications reflect historical trends over a long period of time. This area is also of national interest for culture values. The municipality recommends that marking and refurbishment of the historical features should be done by the so called Border museum (Gränsmuseet). Strömstad municipality also proposes that an extension of the Svinesund area shall be done so that the commercial touch decrease in favor of the cultural values (Strömstad kommun 2003).

TORP AND SUNDBY

Torp and Sundby are two villages in the small scaled farmland. The area pointed out also includes Nordby area. Within this small area there are eleven places with rock carvings and also seven places containing cup marks (Skålgropar) Apart from the rock carvings there are also cairns, settlements and farm remains in the area, dating from the Stone Age to modern time



Svinesundsbron, finished in 1946

(Strömstad kommun 2012). Torp and Sundby also have high landscape historical values where old-time use is preserved. The farmlands are in small scale with lobed shapes and the old farm environment with its traditional design and placement can be seen. The cultural environment in the northern parts of this area have been disturbed by the development of Nordby shopping mall. Many of the values are gone and the scale of the landscape has shifted (Strömstad kommun 2012).

DYNEKILEN

In the area around Dynekilen several historic events have occurred over a long period of time. For example, a road from the 1900s crosses a naval battle field from the 1700s. On the site there is also an ancient castle, with views over the landscape. Other valuable elements found on site are the church, a stone arch bridge, valuable cultural landscapes, older roads, Dyne farm and marine archaeological remains. To preserve the historic significance of the site Strömstad municipality recommends that care efforts should be made to permanently maintain the historical elements. They also recommend additional information points and a more available area to allow further expansion of visitors (Strömstad kommun 2012).

CONCLUSION HISTORY AND CULTURE

The historical land use is shown in the historical remnants and in some places where the farms and agricultural land has been maintained in its original form. These important areas have lately started to lose their former use due to the establishment of external shopping malls on high valued cultural land. Already exploited areas are at risk of an extinction and therefore a greater loss of cultural valuable land.

SOCIAL ASPECTS

This is a summary of interviews made during our second field trip. We asked questions about Nordby shopping mall, the border commerce and how the inhabitants use the natural surroundings.



Retired Berit Rydberg living part time in Brehult, She lives permanently in Lysekil municipality but she grew up by the church in Hogdal. She does not like people to **drive up her private road** to walk their dogs or pick mushrooms in the woods. **"If they want to go out in the terrain they might as well walk and not park their cars everywhere"**. Comments about Nordby: "Yes it is... well have you been there?"



Skanska worker,

He worked with water and sewer for **250 new summer houses for Norwegians**. About Nordby he told us that he thought there were too many Norwegians there. Comments about Nordby: **"Of course that place could do with some parks and green, that's always nice"**, "Take the Norwegians away and it would be nicer, haha..." We think he refers to how crowded it often gets at Nordby shopping mall.



Fisherman Sune Börjesson,

Man in his 70's who we met at a jetty in Stensvik. Before there were only permanent residents in this area but now most of the houses are bought up by Norwegians who use them as summer housing. **"The Norwegians has soon bought all of Bohuslän"**. The society has transformed from a fishing community to tourist society.

Mats and his son Henrik,

The visit Nordby shopping mall but lived in Sandefjord, Norway. Mats and his family visit Nordby 3 times a year mostly **because of the prices**. They sometimes combined the visit with golf, spa or a weekend in Strömstad. They **come to Nordby by car** and they don't know about the closeness to a nature reserve.

Cake Maker Anna Gran Nicklasson,

She lives close to the shopping mall and believe it's really **convenient to live in Nordby**. Nordby is close to both nature and shopping. Her family also **uses the bus commuting system** that goes between Strömstad, Nordby and Halden. One downside with living next to Nordby is the **traffic situation**, every travel have to be planned carefully not to get stuck in the traffic. Anna sees positively on more housing in the area. She also think it **would be nice with something else than shopping in the area**.



Frank in his 40's living in Norby,

He **commutes weekly to Norway for work**. Frank lives on his old family farm with agricultural land where his ancestors had agricultural business. Comment about Nordby: "I don't bother living close to the shopping Mall". But Frank also says that the **traffic can be crazy** around the mall and that he prefers to visit Strömstad where he can find more services.



Two teachers at Nordby preschool,

90% of the kids have one or both Norwegian parents. Most kids live in the near surroundings. The majority of the parents work in Nordby shopping mall or in Norway. The school has 6 full time workers and **a queue of kids wanting to join the preschool**. Comments about Nordby: "There was **previously a school situated close to the mall** but now the kids commute to other schools."

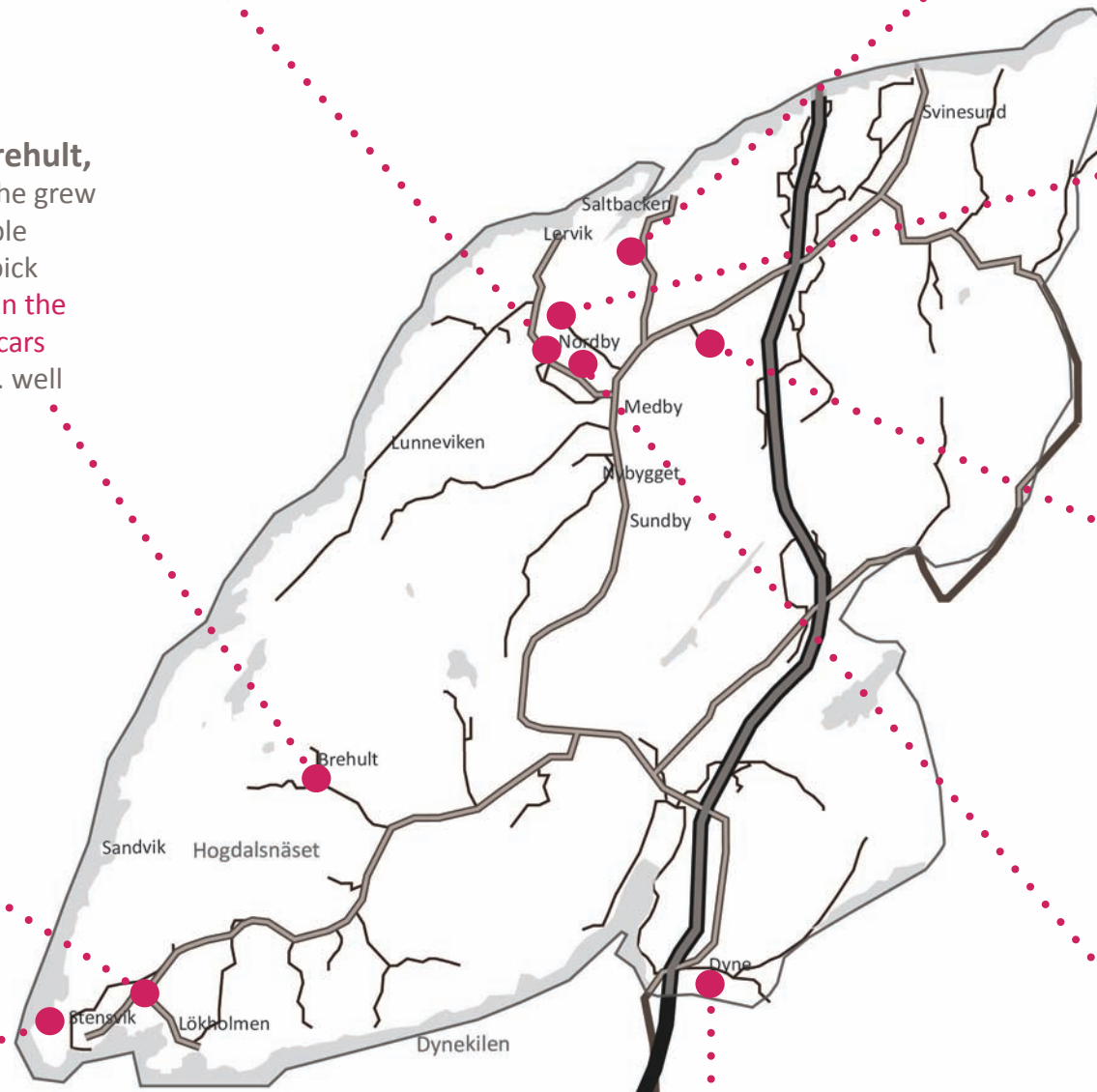


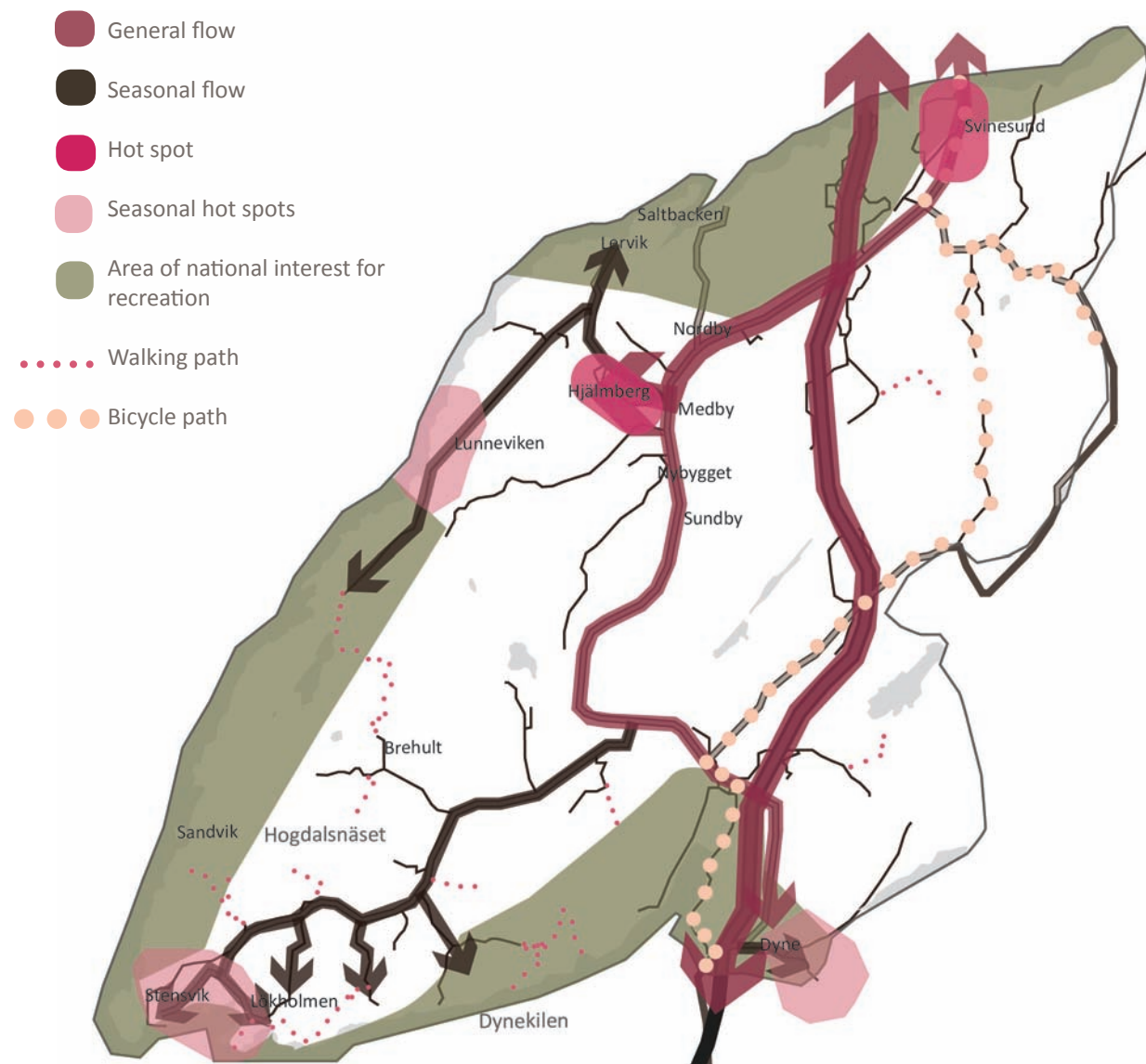
Retired Gunnar and Karin Lundberg

They live opposite Nordby shopping mall. Before they had a bus business and **introduced the first commuting tours** between Strömstad, Nordby and Halden. They also told us that the farmer that owned the land around their house recently **sold his farm to the Norwegian shopping mall owner for 45 million SEK**. The land is planned for a future expansion of the shopping mall. "Now we have to sit here and see how they plan to build a visitor area around us". Gunnar and Karin has no intentions of moving. They told us about the **flooding problem**. Once they had a hard time to get out of their house. "But we had sea view !"

Golf course care taker Yngve,

Yngve lives in Bullarebyggden, 40 km away from the golf course. Yngve tells us about the **cultural differences** between Norwegians and Swedes. He experiences that the Norwegians only think about money have a more aggressive temperament than swedes. And he adds that the Norwegians own most of Bohuslän. Comments about Nordby: **"I never go there, and I don't know anyone who does"**.





SOCIAL MAP

SOCIAL MAP

As seen in this map a large area along the coast is of national interest for recreation. What we found out during our interviews was that the local inhabitants did not make use of this area and many of them had never visit the nature reserve. As can be seen on the map the area is lacking enough paths for walking or cycling.

RECREATION

The area protected for recreation holds a unique landscape values and new development would harm the recreational values and should therefore not be allowed. The recreational value of the area lies mostly in the large undisturbed nature. Today swimming and boating around Hogdalsnäset are not extensive because of few natural beaches and natural harbours for smaller boats. Basically, there is no conflict between nature conservation and outdoor recreation today according to Strömstad Kommun (2003).

SOCIAL HOT SPOTS

The social hot spots, attracting people all year around, are the shopping malls located in Svinesund and Nordby. Nordby shopping mall has 1300 workers and attracts 7 million visitors every year while Svinesund shopping area has 2.5 million visitors every year (Strömstad Kommun 2012). The general flow to and from these places are significant all year around while the flow towards the coast is very fluctuating during the seasons. Along the coast the social hot spots contain swimming places, camping areas, summer housing and harbours which are all strongly connected to the summer tourism activity.

INTERVIEWS RELATING TO SOCIAL MAP

Even though the area holds many important social hotspots and recreational areas they are, according to the locals interviewed, not of priority for social activities. Most locals do not use the shopping malls or the camp sites but leave for Strömstad instead.

The recreational areas are used in a small scale by locals and tourists. Visitors from far away do not recognize the possible recreational activities in the area and are only focusing on the shopping activities.

The interviews show how there is an interest by locals in using the forest and the coast for recreation. Unfortunately the present situation doesn't facilitate high use.

Many people we interviewed around Nordby mentioned it to be an area of strategic importance. For some people it was because of the closeness to Norway and for others, shopping tourism brought in possible customers for local businesses.

CONCLUSION SOCIAL

Big social attractions in this area are the shopping malls and the summer activities along the coast. A large part of the coast is of national interest for recreation. The nature possibilities are not always known among visitors and locals and are little used throughout the year. The bike and pedestrian paths need improvement. There is an opportunity to connect social hot spots with nature values and improve the whole area for all year around activities.

CORELATION BETWEEN CONCLUSIONS



LAND USE

- Forestry and tourism are the main industries.
- Svinesund and Nordby shopping malls attracts many people to the region



NATURE

- The nature contains high valuable water bodies, key biotopes and old forest.
- The dramatic topography contributes to the rich biodiversity but makes the area hard to access.



CONNECTIVITY

- Poorly access with busses to areas over 1 km away from the E6.
- Bike network almost invisible and only as part of a recreational trail.
- No bike paths for commuting.
- Few public roads accessing nature.



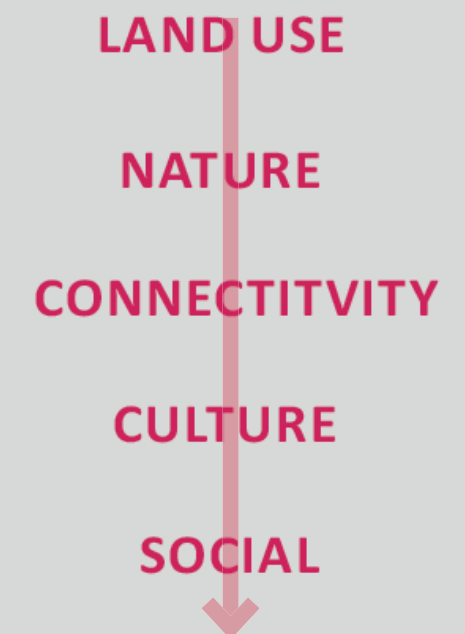
CULTURE

- The area contains many historical remnants
- Remnants in the landscape shows Bohuslän's farming traditions
- Three areas of cultural importance are Svinesund, Torp, Sundby and Dynekilen.



SOCIAL

- Social attractions are shopping malls and coastal summer activities.
- Recreational areas are unknown of and little used throughout the whole year.
- There is an opportunity to connect social hot spots with nature values.



The dramatic topography and varied landscape with many cultural remnants give the area a rich diversity. Hence it is hard to implement new infrastructure and paths from a physical point of view without disturbing nature and cultural values. This together with the fact that the area is sparsely populated throughout the year might be the reason for the poor accessibility especially for alternative transportation, such as busses and bikes.

The high amount of people moving through the area are do so mainly along the E6, the shopping malls and in the camp sites summers in. By a more site specific future development the people flow can contribute to establishment of local anchored businesses and experiences. This would decrease the current vulnerability and strengthen the area with focus on more than commercial market and with a more local touch.

ANALYSIS

LCA

SWOT/PEBOSCA

LCA - CHARACTER AREAS

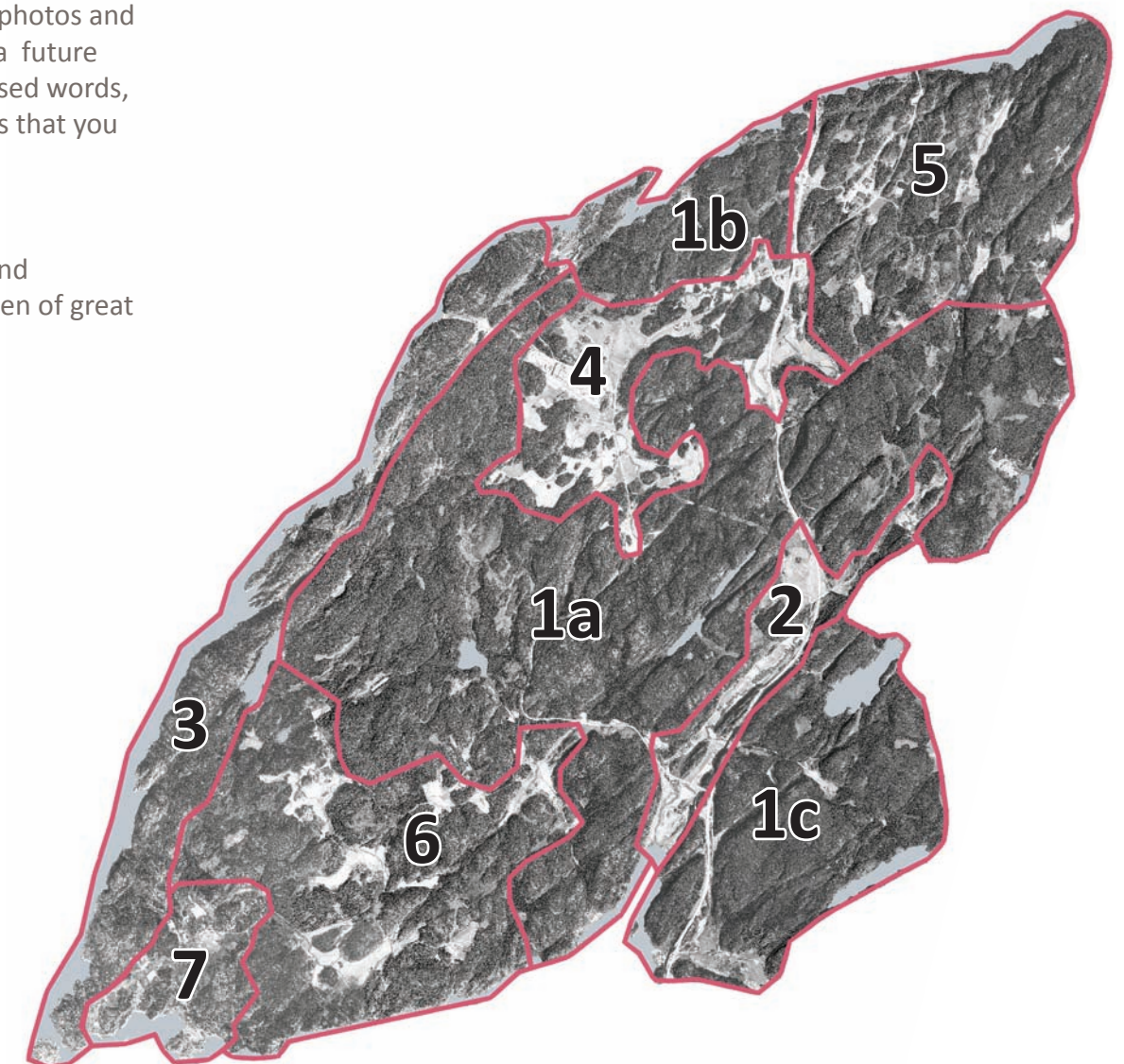
Method

In this second scale LCA we have been driving and walking through the area to get a feeling of the different characters. We have also gathered information through documents from the municipality, orthophotos and from our inventories. All in order to formulate guidelines for a future development in each area. On the following pages we have used words, pictures and sections to describe the different character areas that you can see on the map.

Our approach

The LCA has helped us to understand the different qualities and sensitivities of this rural and forested landscape which has been of great help in our analysis and later on in our vision and proposals.

- 1.A. ASKEMYR HIGH FOREST
- B. UNDULATED FORESTED FJORDLINE
- C. DYNEKILEN FOREST
- 2. HOGDALSBACKEN VALLEY
- 3. BARREN COASTAL AREA
- 4. AGRICULTURAL LOWLAND
- 5. SVINESUND
- 6. BERHULT LAKESIDE MOSAIC
- 7. LOWLAND CAMPING



1A. ASKEMYR HIGH FOREST

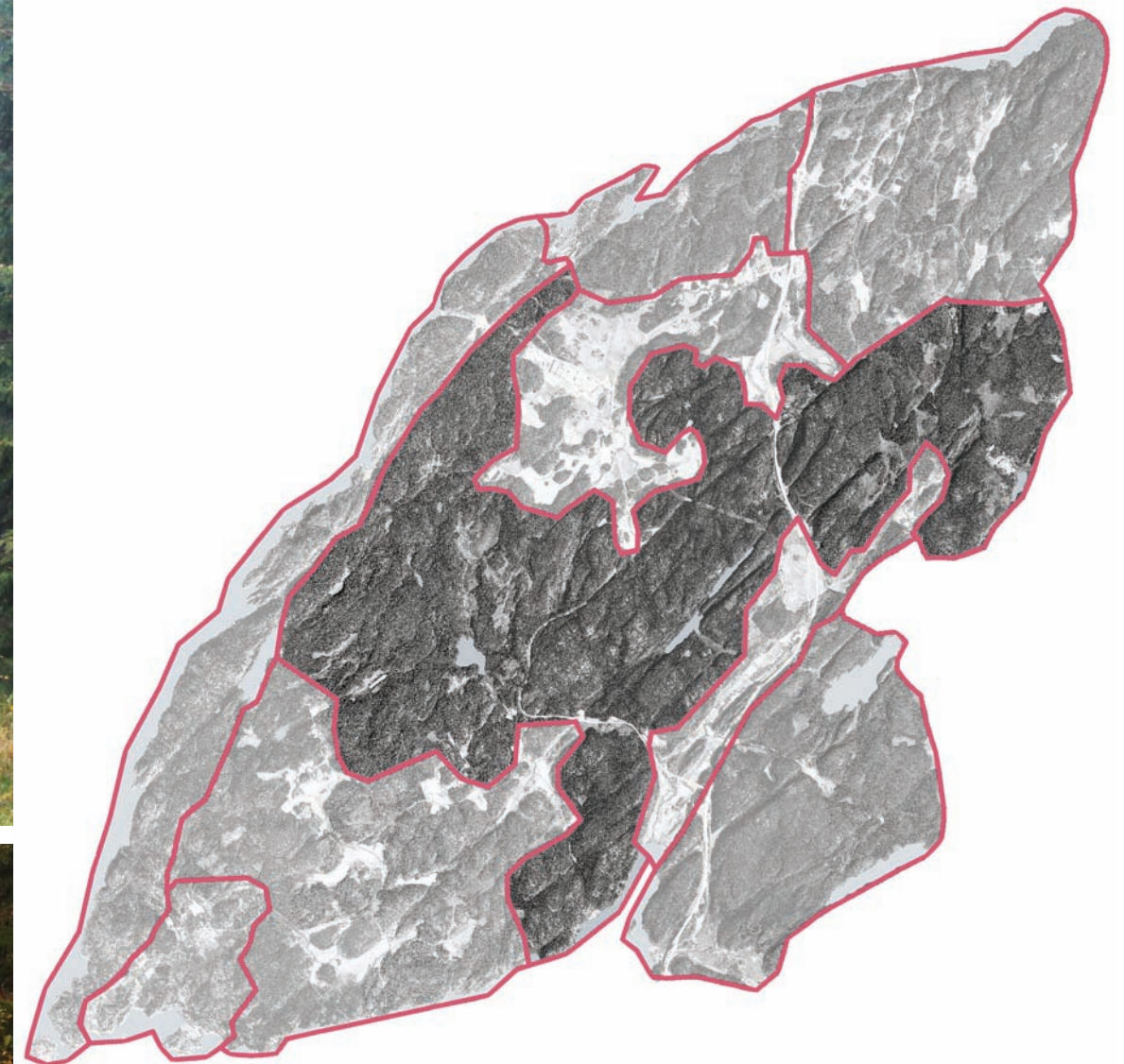
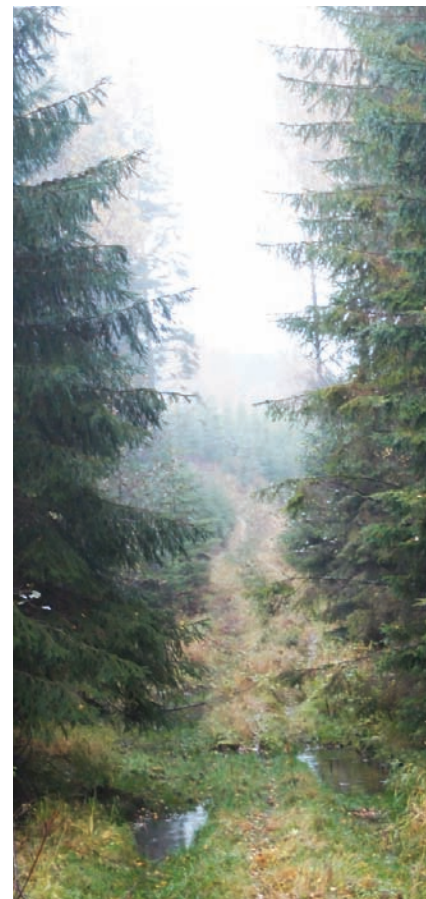
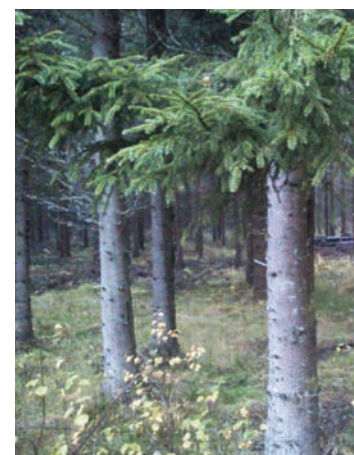
Askemyr high forest is a hilly highland with dense uninterrupted forest containing mainly coniferous trees and many water bodies. The forest stretch from west to north east and presents a green belt with a quiet and remote feeling. The three smaller lakes; Koboltvattnet, Hattefururös and Trolltjären, are situated in the rift valleys and surrounded by bogs and wetlands. The area has a high developed forest industry which has an old history that can be seen in the landscape. Many years of forestry has left tracks in the landscape with clear cuts, halls of perfectly planted pine trees, small unmaintained roads and deep wet furrows from heavy machines. In the rare open lowlands there is an on-going smaller agricultural industry. Remnants have been found from previous settlers and land users in form of archaeological sites. The road network is undeveloped due to few settlements in the area. The few settlements that can be found are often located close to the lakes or the road E6. The area is highly affected by the old and new E6 that cuts through the landscape and leave an island habitat in the middle. The roads also contribute to a high noise disturbance within an area of approximately 500 m.

Sensitivities

Askemyr high forest has a fairly large uninterrupted patch of forest that would be sensitive for disturbance from new activities and development. Especially sensitive would be the already fragmented landscape along the big road. Key biotopes are now situated in the habitat island between the old and the new E6. One of the high protected wetlands, called Långemossen, is situated close to Nordby shopping mall. With further development the wetland could be under a threat of extinction.

Our guidelines

- Avoid measure that will fragment the landscape further and make sure that new development doesn't disturb forest industry.
- New development should also work for a decrease of existing fragmentation of land.
- The dramatic landscape should be more visible and the high topography could be used for leisure activities, such as mountain biking and mountaineering.
- A new development should make as little negative impact on the large forest patches as possible.



1B. UNDULATED FORESTED COASTLINE

This coastal landscape is dramatic with high mountains in the east facing the fjord and a lower part in the west where the fjord meets the sea. In the lower part you can find the neighbourhoods Lervik and Saltbacken. The undulated forested coastline has a high density of part-time housing. From the lower western land the visibility over the water to the steep mountain walls on the Norwegian side are clear. Driving through the high land on the water on the east side is less visible and the nature is less affected by strong winds thanks to the protection from the inlet walls. Here grow a mixed forest of coniferous and broad leaf trees such as *Picea abies* and *Betula pendula*. The forest grows mainly on a thin soil layer on high altitude rocks. In the eastern rift valley forested marshlands can be found. Kobbungsbäcken flows from the inland out to the river mouth west of Lerviken. This area is of interest for recreational and historical purposes. Many remnants from previous land users can be viewed thanks to location done by the Eco museum Gränsland, the border museum. The only roads through the landscape go from the neighbourhoods Lervik and Saltbacken and out to Nordby shopping mall, from where there are connections to busses.

Sensitivities

The undulated forested coastline holds many sensitive biotopes dependent on water presence. The water body of Idefjorden holds an extra sensitive habitat due to its threshold and would be highly affected by higher traffic.

Our guidelines

- Due to actual plans on an expansion around the catchment area of Kobbungsbäcken the river should be protected through a nature reserve.
- We propose as little new development as possible in this area considering the high valued biotopes and the protected water bodies that can withstand pressures from higher water use and disturbance.
- The contamination from roads and hard surface areas in the surrounding should be taken care of before it reaches the protected area.



1C. DYNEKILEN FOREST

A large part of this area contains industrial forest but the influence of tourism is high in the southern parts with a camping area and a golf club. Dynekilen fjord plays an important role in history where a significant battle between Norway and Sweden that took place in 1716 (Strömstad tidning 2012). Dynestrand camping is situated along the inlet, offering summer activities and small cottages. Further inland on the low land Dynekilen golf club can be found. The nature surrounding the tourist attractions contains small interrupted patches of pine trees, mixed forest, lakes and streams or open low lands used for agriculture or grazing. The glacial forest shows ridges and landslides making the thin soil layer visible. This is a transition zone between the boreal coniferous forest and the maritime-influenced flora along the exposed west coast. Character pine trees affected by the wind, salt and rain meet the more herbaceous flora from inland Bohuslän. This forested area has the highest heterogeneity and the human impact is evident. The E6 cuts through the agricultural landscape before it goes up on a bridge over Dynestrand camping area. The closeness of the highway gives a high noise disturbance in the area affecting humans and animals.

Sensitivities

Because of the many streams and water bodies Dynekilen forest is sensitive to pollution from the road and leaching of nutrition and fertilisers from the golf club. It is also sensitive to dredging of lakes and fjords in order to create beaches for tourism or blasting of rock for new development.

Our guidelines

- Dynekilen camping area should be combined with water and soil treatment of pollutants from surrounding activities.
- Further development of all-year-around activities such as cross-country skiing.
- The area already has a social base to develop further into being social meeting for both tourist and permanent residents.
- The golf course should develop an ecological approach that will have less effect on the water conditions and the surrounding habitat.



2. HOGDALSBÄCKEN VALLEY

The area is mainly represented by the plains along the river Hogdalsbäcken and the continuous soil cover of clay and silt provide good conditions for agriculture. Hogdalsbäcken ends in the fjord Dynekilen and meanders through the landscape due to the gentle slope. The discontinuous riparian corridor varies from inexistent stretches to large and linked with the surrounding forest patches. The river is an important area for spawning and nursery of Sea Trout (*Salmo trutta trutta*) (Strömstad kommun 2008). The river plain flora is of a meadow and pasture character. The surrounding nature dominates by cropland and smaller patches of coniferous and deciduous trees along the steep mountain walls framing the river corridor plain. The valley is protected from wind and against the warm south mountain walls grows broad leaf trees, such as *Quercus robur* and *Fagus sylvatica*. Closer to the river grows trees that indicates wet area and high ground water, such as *Alnus glutinosa*. The E6 in the eastern edge of this area is a visible and physical barrier as well as a noise disturbance.

Sensitivities

The area holds a high and unique habitat value thanks to the river biotope. It is therefore extremely sensitive to a restriction of the river's meandering freedom, eutrophication, soil erosion and particle pollution from the road. Due to the narrow width of the river corridor new settlements in the area would highly affect the landscape negative.

Our guidelines

- We would like to see preservation of the open landscape through maintenance and restriction to new development.
- The negative impacts of the road should be managed through reconnection of habitats, conscious plantation of remediation plants along the road and reduction of noise.
- The river movements should not be restricted through new development and the riparian corridor should if possible be widened to be able to withstand high water quality.



3. BARREN COASTAL AREA

The barren coastal area distinguishes itself severely from the rest of Hogdalsnäset. The most important components contributing to the unique character is the large visible bare rocks with interrupted vegetation and the non-vegetated steep cliffs. This area is strongly affected by the salt, wind and rain from the sea. A fault line creates a mountain ridge going through the landscape that gives the area its dramatic topography going from lower in the north to higher in the south. The direction of the movements of the inland ice is visible here, more so than in any other area. The rift valleys start in the north-east and meet the sea in the south-west. This affects the accessibility and the sensational feeling in the area. The only road goes through one of the rift valleys where most of the surrounding nature is hard to access leaving this place a remote and quiet feeling. In the rift valley the presence of the sea is less noticeable but looking up on the high plateaus the old windswept pine trees reveals the closeness to the sea. On the highest plateau, said to reach 120 m above sea level, stands the nature reserve Halle-Vagnaren with old characteristic trees (Naturvårdsplan Strömstad kommun 2008). The rift valley east of Halle-Vagnaren holds the one kilometer long lake Vagnsjön. Travelling on the main road in the landscape it is easy to miss the entrance to the nature reserve. The road winds through the north camping area Lunnevikén that is mainly used during summer. Later on the road passes the closed port of Kålviken, previous used as a deep sea port, on its way up to Nordby shopping mall.

Sensitivities

The many key biotopes and valuable nature reserve make the area sensitive for further development. Even future climate change with higher temperatures and more rainfall will affect and change the landscape. The area has important but inaccessible values for recreational purposes but has also areas of high sensitivity to exploitation for tourism.

Our guidelines

- We suggest a preservation of the landscape with little further exploitation in order to secure a good water quality and the unique biotopes.
- This area will be highly affected by the on-going climate change and we would therefor like to see no expansion of the camping area or development of permanent settlements.
- The tourist routes should be developed in order to make the unique nature understood and accessed. The development of tourist routes should show selected nature and be managed in a way that has as little impact on nature as possible.



4. AGRICULTURAL LOWLAND

This is the lowest part in Hogdalsnäset, a former seabed containing a large depression of clay and silt. This landscape was earlier a large continuous agricultural land but has faced a dramatic change due to European regulations and the establishment of Nordby shopping mall. The main industry today is commercial business and most of the arable open land is abandoned or used for grazing animals. The landscape is of cultural importance and present visible traces of how land was traditionally used throughout Bohuslän. The flat valley provides many sightlines and is surrounded by mixed or coniferous forests on elevated areas with elements of bare rock. Through the valley winds the river Kobbungsbäcken that ends in the Idefjord. The land around the river contains a floodplain flora due to the river's constant flooding in high rainfall. The private neighbourhoods are situated in the border between the open plain and the forest. The agricultural lowland has a high frequent visit of humans with the main shopping centre at Nordby and the kindergarden north east of the shopping mall. The old E6 influence the landscape and is a high noise disturbance.

Sensitivities

The specific open landscape is rich in biodiversity and important for the visible landscape it is also highly sensitive to change of land use and reforestation that could lead to a loss of high nature values. The river Kobbungsbäcken and its floodplain is sensitive to particle pollution from the road of polluted water from hard surface runoff.

Our guidelines

- Use the attraction of the shopping mall to enhance a greater understanding and attraction to the nature and culture values in the surrounding.
- The treatment of water from hard surfaces should be incorporated with educational purposes.
- We would like to see a maintenance that keep the open land and its values.
- We can see that an improvement of the intersection is needed but we would also like to look at solutions that not only covers transportation by cars but by public transport, boat and bikes.
- New buildings in the area should be attached to existing settlement and placed carefully in the landscape considering the cultural landscape.



5. SVINESUND

Where the landscape faces Idefjorden it drops dramatically and leave steep forested mountain walls. The topography is hilly and contains a mountain plateau facing the fjord. On the plateau grow old clusters of pine trees of high biological value. Moving inland the forest contains mainly coniferous trees with patches of deciduous trees. Away from the direct edge of the fjord the presence of the fjord is invisible and instead the landscape gives a feeling of being deep inland with a landscape that frequently opens up in small agricultural areas to later on close itself with dense forest used for forestry. Two smaller streams run through the area and ends in Idefjorden. The mixed land use and remnants in the landscape, such as stonewalls framing the agricultural land, witness of a long human history in the area. The new established Eco Border Museum highlights this area, especially around Svinesund's bridge, as of national interest for culture and recreation (Strömstad kommun 2003). Svinesund's bridge is highly visible along the fjord and most of the settlements in this area are located around the bridge and in open agricultural areas. Svinesund has more recreational paths compared to the rest of Hogdalsnäset. On the eastern side facing Idefjord the landscape is shaded most times of the year which means that the snow stays longer in winter time providing good conditions for cross country skiing².

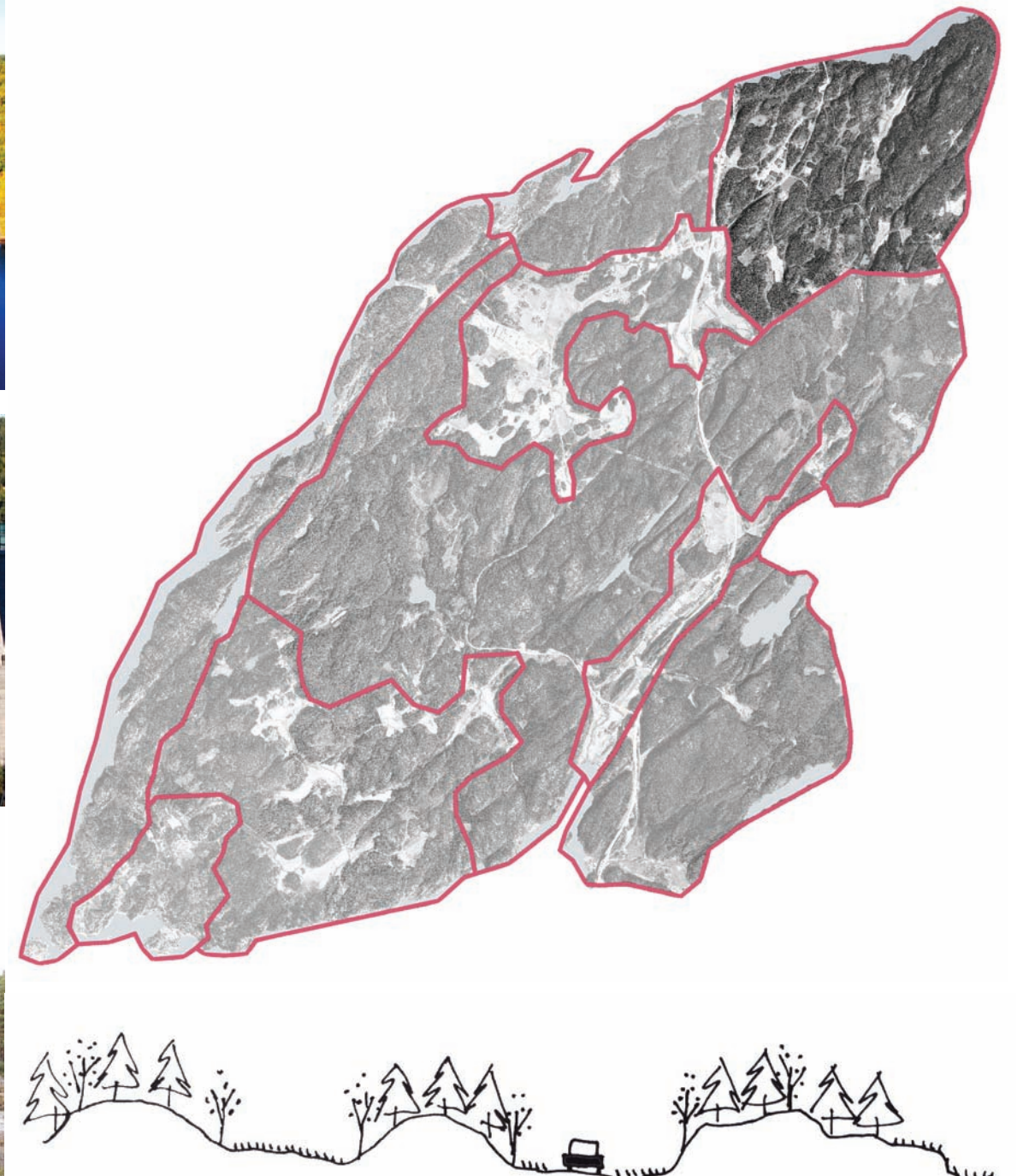
Sensitivities

The heterogenic landscape containing small patches of biotopes could be sensitive to fragmentation where it wouldn't take much to lose important biodiversity such as the unique threshold fjord.

Our guidelines

- A further development, together with the Border museum, with a focus on cultural and historical values is welcomed.
- The recreational paths and infrastructure is well developed in this area but needs to be connected and spread to the west of Hogdalsnäset.
- A new development should maintain the heterogenic character and the open-close landscape picture.

² Espen Sørås overview planner at Halden municipality, interview the 17th of October 2013.



6. BREHULT LAKESIDE MOSAIC LANDSCAPE

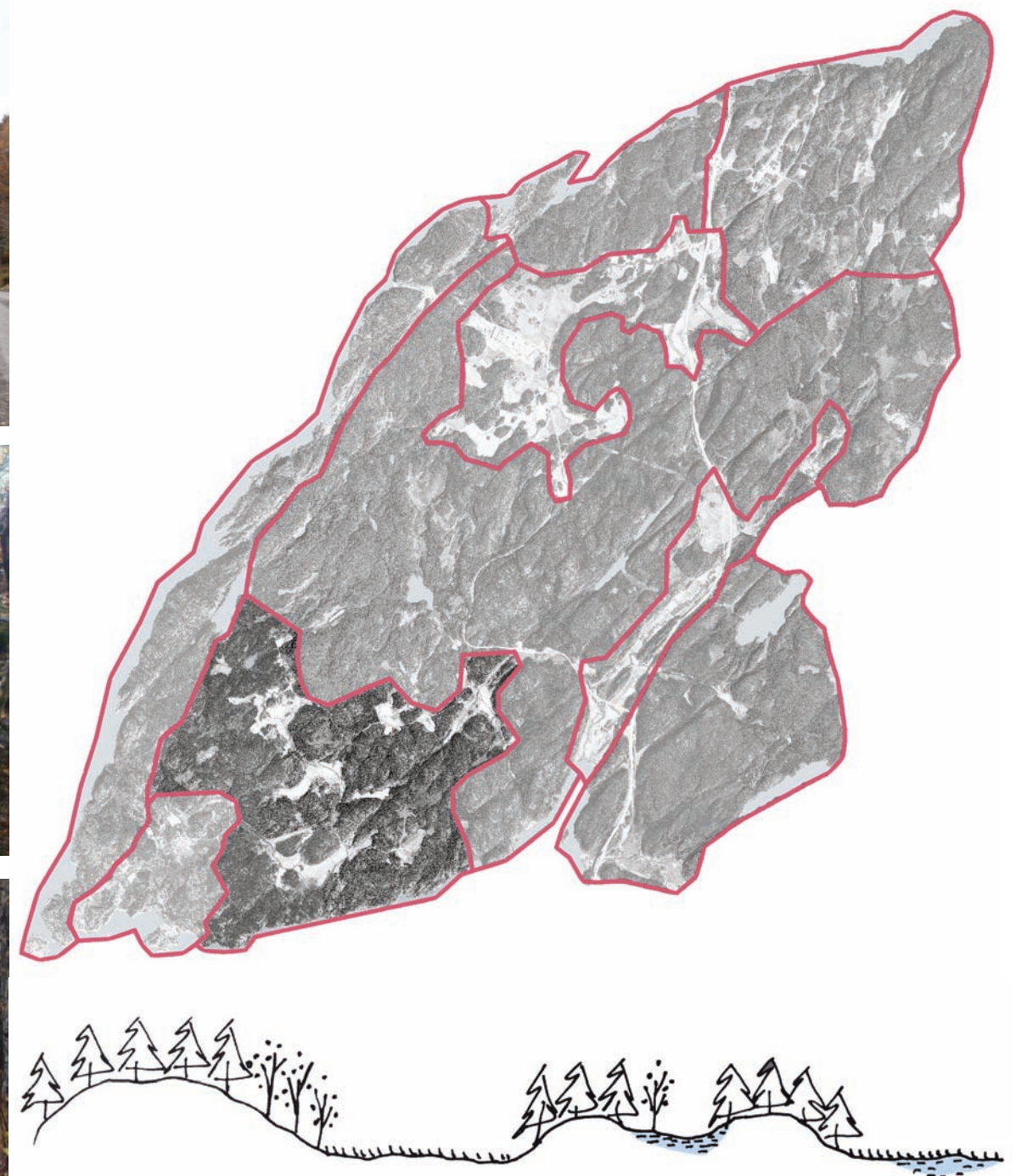
The inland is wet with many small streams, lakes and wetlands. This large area is less dominated by forest but is a landscape of even patches of open agricultural land, dense forest, clear cuts and lakes. The landscape goes from open to close in short sequences and makes the visitor feel like being in a remote place far away from civilization. Broad leaf trees exist in the borders along mountain walls and cultivated land. This is an area with very little influence by tourism where the local people and their cultivation of the landscape have created the character of the place. An historical important place called Mörk Tuveröd is situated below road 1037. Today's settlements are scattered in the landscape except from one cluster of five farms called Brehult. In the south the area faces the fjord Dynekilen which is of national interest for nature conservation and for recreation (Strömstad kommun 2003). East of Lökholmen a pump station is situated that provide the center of Strömstad with water.

Sensitivities

The high biodiversity in the area due to a large variety of biotopes and large patches is sensitive to fragmentation caused by future development. The fertile soil patches are sensitive to soil contamination by fertilizers and mismanagement. The many water reservoirs of regional and national interest are sensitive to dust and contamination.

Our guidelines

- There's a need for an expansion of public roads to access nature.
- We therefore suggest an expansion of existing road net and an improvement of public transportation and bike routes to the recreational areas including the many water bodies.
- We would like to see maintenance of open farmland or a sustainable alternative use of former farms.



7. LOWLAND CAMPING AREA

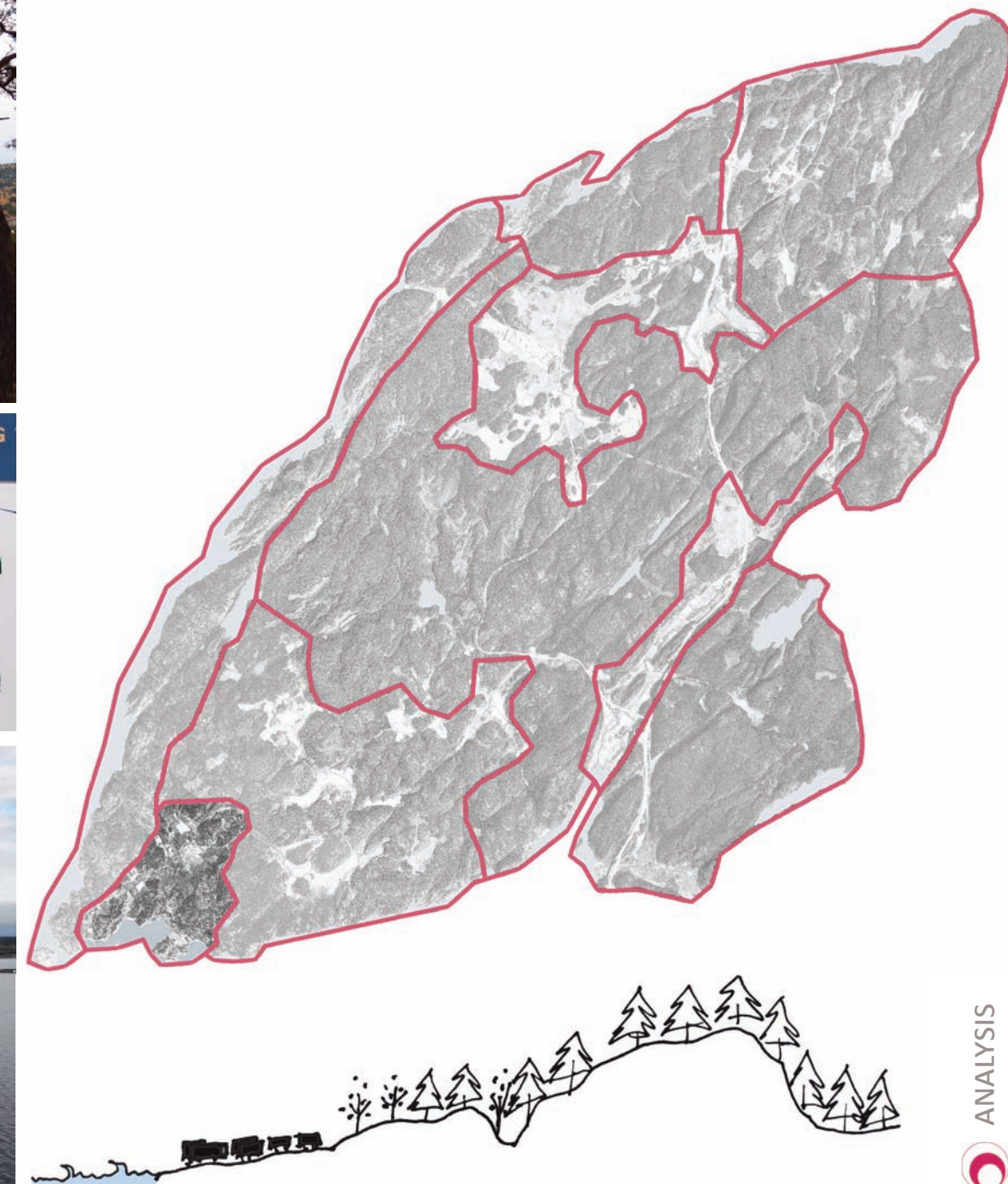
The lowland camping area is built up on the border where wide rift valleys meet the sea and creates flat large beaches. The settlements are situated on the flat low land surrounded by higher mountain plateaus from where the sight lines out on the sea and the island are many. In the valleys the vegetation is visibly affected by the wind and has grown into a unique character. On the plateaus the trees grow less dense with discontinuous groundcover of lichens and bryophytes. Except from lawns around the settlements the vegetation in the valleys consists of open meadow for grazing animals or leafy forest. On the higher plateaus coniferous forest is dominant. The river Kongbäcken runs across the area from Vagnsjön and Kolbovatten out in the fjord Dynekilen. The visual landscape is highly affected by tourism though this area holds two main camp grounds and a small area of permanent houses at Lökholmen. The area is highly affected by seasonal fluctuation of population and is quiet and abandoned in autumn and winter time. There is one larger road going through the open landscape and connecting the different campgrounds to the national E6. Around the area there are also plenty of smaller roads providing access to the farms and houses on the countryside.

Sensitivities

The recreational values of the coast could be sensitive to an overexploitation of the coastline and abrasion from tourism.

Our guidelines

- The presence of the coast and the fishing history allow this place to further develop social activities around the water and the fishing that would attract people all year around.
- Focus should be on an extension of the tourist season and on establishment of permanent local services.
- The local forces and resources should be the driven factor to create a living environment all year around.



SWOT/PEBOSCA

Method

From the previous detailed studies on the 2nd scale we have gained a broader understanding for our specific area. We have chosen to do a SWOT- analysis based on our information. To make sure we cover the important aspects we have categorised the SWOT-analysis under the PEBOSCA framework (read more about the framework in our first scale on page 22)

Our approach

By doing this analysis we have deepened our understanding for the area. We have also made the strengths and the challenges of the area more clear which has helped us when formulating our proposal for further development in the area.

STRENGTHS

PHYSICAL RESOURCES

- Diverse physical resources and a heterogenic landscape is offering a wide range in possible uses of the land.
- Protecting topography serves as wind barriers, noise barriers and creates a good microclimate in the valleys.
- Large amount of forests.
- Bohuslän granite serves as an asset in the area and offer a stable ground to build upon.

ECONOMICAL RESOURCES

- Nordby shopping mall enhances the economical growth in Strömstad Municipality.
- Strong people flow to shopping mall and tourist attractions that support the economy.
- Trade flow with Norway through Nordby shopping mall.
- High valued land.
- High prises on houses due to the high demand on summer housing for Norwegians.

BIOLOGICAL RESOURCES

- Unique fjords and marine habitats.
- The varied landscape supports a rich biodiversity.
- Many protected areas along the sensitive coast that hold special values.
- Nature of high value that is hard to access and therefor is more likely to be preserved.
- Many streams and wetlands that gives ecosystem services such as purification of water.

ORGANISATIONAL RESOURCES

- Bus connections from Strömstad to Halden passes through the area.
- Closeness to bigger settlements such as Halden and Strömstad.
- E6 connects the area with Europe and all the way up to Russia.
- Many work opportunities in the external shopping malls.
- The area offers a unique opportunity to live a rural life close to work and shopping.
- Good water connections where the deep harbour could fill an important role.
- Collaboration with Norway that can strengthen the region.

SOCIAL RESOURCES

- Vibrant summer location with a lot of tourism that brings life to the area - especially along the coast.
- The area has social hot spots such as the shopping malls where many people are gathered at the same time that can be developed further.

CULTURAL RESOURCES

- The areas long history is visible in the landscape.
- Two equally strong national cultures, Swedish and Norwegian.
- Strong identity of “summer paradise”.

AESTHETIC RESOURCES

- The Fjord and the See are beautiful natural features and the unique and dramatic landscape along the coast.
- Many sight lines from the mountain tops.
- Heterogeneous landscape with a rich diversity to experience.
- Attractive coast for the tourism and part time housing.

CONCLUSION

The biggest strengths of the area lies in the diverse landscape with both biological, physical and aesthetic qualities. But also in the strong economy due to the high Norwegian purchasing power and in the high amount of people moving through or visiting the area.

Pictures from top left: 1,2,3; The area contains a broad diversity in landscape characters. 5; The external commerce attracts many people - photo taken by S. Salihi/P4 väst.



WEAKNESSES

PHYSICAL RESOURCES

- Dramatic topography lessen the accessibility and make construction work difficult and expensive.
- Infrastructure is based in the lowlands which makes them prone to flooding
- A small scale fractured landscape decrease the possibility to build large conventional industries.
- The large areas with thin soil cover is a challenge both for agriculture and forestry where a profitably industry is hard to achieve.

ECONOMICAL RESOURCES

- Economic development forces locals to move or change the way they use their land.
- High dependence on the Norwegian purchasing power and currency exchange makes the area vulnerable to change.
- High prices on land makes it hard for locals to afford housing.
- Seasonal fluctuation of people causes difficulties for markets during winter, specially along the coast.
- Tax revenue does not reflect population throughout the year.

BIOLOGICAL RESOURCES

- Hard surfaces fragment habitats and bring polluted water in to streams and rivers.
- There are many species (some of them red listed) sensitive to disturbance and a change of land use might have negative effect on some species.
- High pressure on coastal habitats due to swimming and other recreational activities.

ORGANISATIONAL RESOURCES

- The sparsely populated countryside result in less public transport and car dependence.
- There are no services like hospitals, pharmacies or schools in the area.
- Lack of high academic education and no demand for academic workers when most of the jobs are in commerce.
- Restriction from the municipality for future development on permanent housing in the area.

SOCIAL RESOURCES

- Cultural differences between Norwegians and Swedes - could result in conflicts.
- Few meeting places that are focused on social interaction for both locals and tourists.
- High amount of tourism might disturb locals and the area sometimes lacks a feeling of togetherness due to the fluctuation of people.
- The area is sparsely populated in winter and it can be perceived as spooky along the coast with the abandoned camping areas.

CULTURAL RESOURCES

- Loss of agricultural and fishing identity due to a change of land use.
- High pressure on cultural valuable land.
- Lack of consideration for cultural remnants - Nordby is built on a very important cultural site.
- Lack of identity when mixing nationalities in the border region.

AESTHETIC RESOURCES

- Difficult to access good viewing points due to the dramatic topography and lack of recreational paths.
- Big developments with E6 and shopping malls on open lowland have a dramatic impact on the visual landscape.

CONCLUSION

The biggest weaknesses of the area is the low diversity in economic activities, the dependence on the Norwegian krone and the car focused development where biological, aesthetic, cultural and social resources are given little focus with few social meeting points.

Pictures from top left: 1 and 2; A lot of focus in the development lies in summerhousing and camping areas especially for Norwegians 3; The E6 is fragmenting the landscape and bringing pulutants to the surroundings, source - web cam Nordby. 4; The car focused development is shown in the big parking area at Nordby shopping mall.



OPPORTUNITIES

PHYSICAL RESOURCES

- Many large flood plains along rivers can be used for water treatment and flooding protection.
- Use E6 connectivity for new development including more permanent housing.
- A road network that allows an expansion and attachment of bike paths and recreational walks would strengthen the accessibility to the interesting landscape.
- The diverse nature.

ECONOMICAL RESOURCES

- The high Norwegian purchasing power push developments in the area.
- The big flow of people could enable development of new markets that could be connected to more local businesses.
- Kålvik deep sea harbour could be developed and used.
- Development of new housing for permanent inhabitants would increase the amount of tax payers.

BIOLOGICAL RESOURCES

- Ongoing reforestation of agricultural land creates new habitats.
- The rich biodiversity could be strengthened by a reconnection of habitats and a treatment of water and soil to remove pollutants.
- Better access to nature would make people more aware of its values.

ORGANISATIONAL RESOURCES

- New bus routes to access country side could make it more attractive to live there all year around.
- An expansion of the railway and other public transportation would release traffic pressure from the E6 and increase the connectivity.
- Encourage higher educational levels for a broader diversity in people living and visiting the place.

- More cooperation with surrounding Bohuslän region and Norway would strengthen the functional region as a whole.

SOCIAL RESOURCES

- A stronger identity with less focus on tourism and shopping and more focus on social activities all year around would strengthen the area and make it a more livable place for locals.
- Take advantage of the hot spots and flows to create good places for social interactions focused on both locals and tourists.
- The nature and the sea could be developed further for social activities and sports.
- Natural meeting point between Norway and Strömstad (Swe) could be established here.

CULTURAL RESOURCES

- Work for a greater understanding about cultural remnants in order to better protect them.
- New land use and maintenance of open cultivated land combined with social activities would strengthen cultural identity.

AESTHETIC RESOURCES

- Make the unique heterogenic landscape more visible.
- Increase the understanding for aesthetic values to protect and care for them.
- Many unique qualities in the landscape with visual traces from the inland ice and the historical land use could be enhanced to strengthen the identity of the place.

CONCLUSION

There are many opportunities in the area where the unique qualities could be used and developed to create a large diversity of use in the area. The big flows of people makes a great opportunity to create places for social interactions and more local anchored businesses.

Pictures from top left: 1 and 2; A better connectivity to the unique nature would strengthen the identity of the area. 3; The big flow of people creates opportunities for a more local anchored commerce like Annas Gran's local bakery close to Nordby shopping mall.



THREATS

PHYSICAL RESOURCES

- Climate change affecting sea level rise, change of habitats and flooded settlements.
- Flooding of hard surfaces brings pollutants out in the sensitive surroundings.
- Building expansion threaten the habitats and the visual landscape.
- Clay and silt in valleys means a risk of land slides in heavy rains.

ECONOMICAL RESOURCES

- A weakening of the Norwegian krone would decrease the Norweigan purchasing power and therefor threaten the external shopping malls and also decrease the value of the land including housing.
- Not much land available for development of markets, industry and housing.
- If all land is bought up buy Norwegians for summer housing or commerce there will be no permanent residents left to pay taxes in the area.

BIOLOGICAL RESOURCES

- Dust and noise disturbances from E6 and shopping mall expansion is disturbing the habitats and people living in the area.
- More infrastructure would fragment the landscape further and bring more pollutants to the water and the soil.
- Risk of losing unique fjord habitat around Idefjorden if Norway removes the threshold.
- Risk of high pressure on nature if tourists and locals are not directed to paths carefully put out not to disturb sensitive habitats.
- Increment of tourism and camping areas along the coast will increase pressure on the coastal habitats.
- Change of land use threats special habitats.
- Acidification of lakes.

ORGANISATIONAL RESOURCES

- The focus on tourism and shopping makes it hard for other businesses to establish in the area.
- Difficulties in collaboration with Norway due to EU regulations.
- Focus on car dependent commuting makes it hard for regional cooperation for an expansion of public transport.

SOCIAL RESOURCES

- Loss of identity due to focus on tourism (attracting an excessive amount of tourists).
- Expensive housing makes it difficult for permanent residents to afford to stay in the area.
- Lack of social meeting points and loss of identity might result in a emigration of permanent residents.
- Urbanization takes local services away from the area.

CULTURAL RESOURCES

- Reforestation of high valued and historic agricultural land and the loss of fishing industry might lead to a loss of place.
- Risk for the cultural remnant to fall into oblivion over time.
- Changing in culture and land use might lead to a decreased understanding of the landscape history.

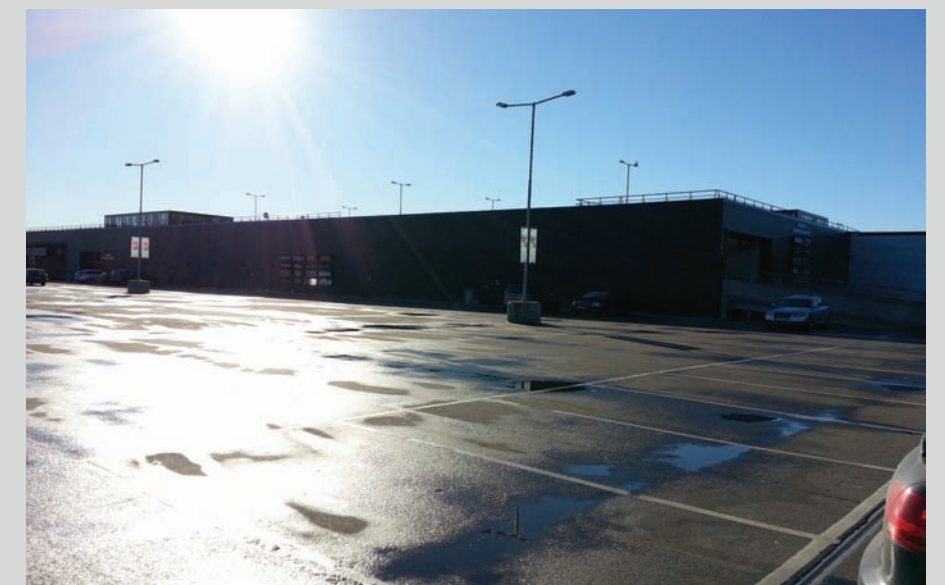
AESTHETIC RESOURCES

- Loss of visual beauty because of changes in land use.
- Big infrastructures and expansions in the landscape can have a negative impact of the visual landscape.

CONCLUSION

The biggest threats in the area is the ongoing car dependent development where visual and biological values in the landscape are at risk of being damaged. That the Norwegian purchasing power decreases before the area has a chance to be developed to support more diverse economic activities.

Pictures from top left: 1; The focus on the commerce and tourism leads to a change in land use and a reforestation when the agricultural land is taken out of use. 2, 3; A decreased Norwegian purchasing power could lead to abandonment of parking areas and camping sites, leaving wounds in the nature.



SYNTHESIS OF INVENTORY AND ANALYSIS

CHALLENGES

CHALLENGES

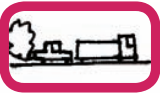
Method

We have divided the challenges in three different categories and represent them visually on a map. This allows us to describe them more in detail. Later on we combine these categories to show the complexity of challenges. The combination of challenges gives us a better understanding of challenges clusters of high importance.

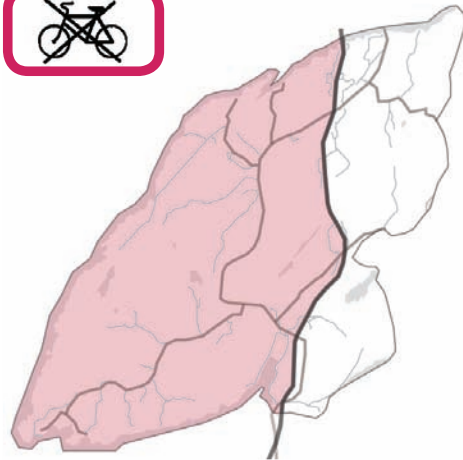
Our approach

In order to decide the best place to act and where an application of our solutions would be most effective we use the complex challenges map to find challenge clusters. This knowledge we then use to detect the area where we want to develop further.

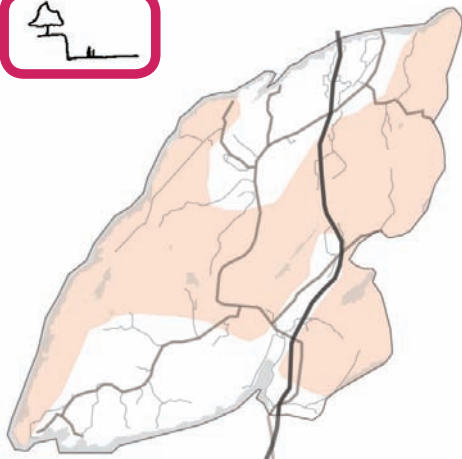
CHALLENGES RELATING TO CONNECTIVITY



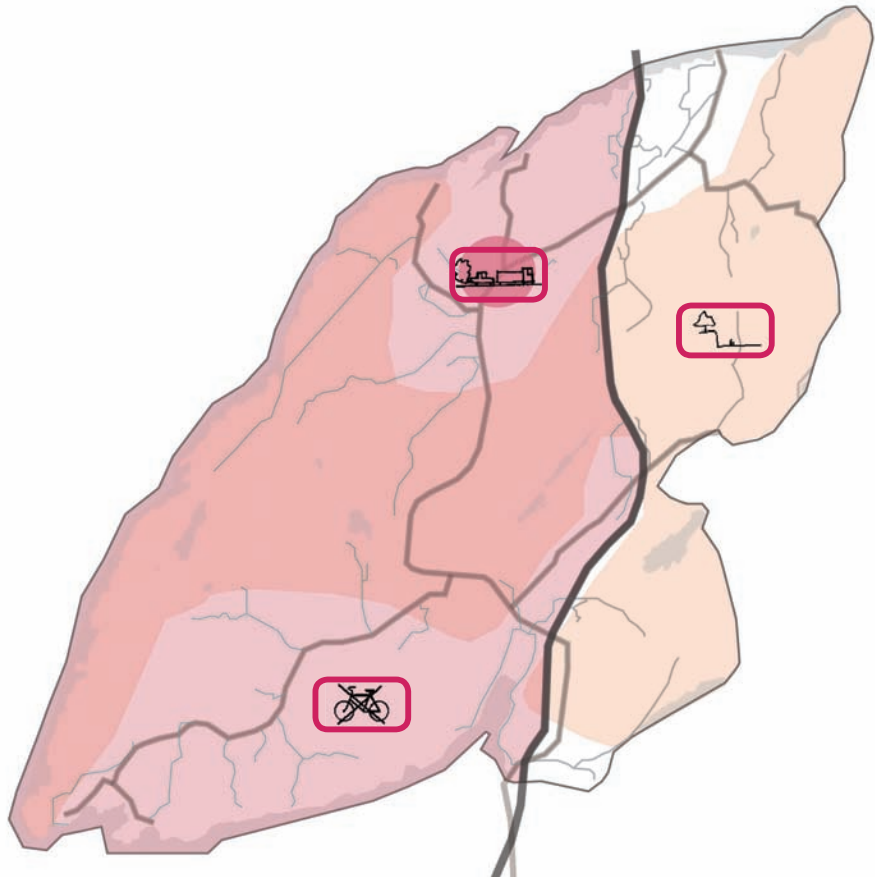
TRAFFIC INFRASTRUCTURE NOT MEETING DEMAND
Around public holidays or during the summer months the traffic at the bottleneck crossing, between road 1038 and the old E6, is intense with significant traffic stockings. This is due to the poor conditions not meeting demanded speed and the amount of cars. This problem appears mainly around Nordby shopping mall where the flow of people is concentrated.



NONEXISTING PUBLIC TRANSPORT AND BIKE PATHS
This problem is found all around Hogdalsnäset. The of biking facilities makes people car-dependent and impede them to commute, access and enjoy the surroundings away from the main roads. As mentioned before in the layers maps, many of the large forest areas can only be reached by foot (Strömstad kommun, 2003). Public transport lacks structure and leaves rural areas almost disconnected.

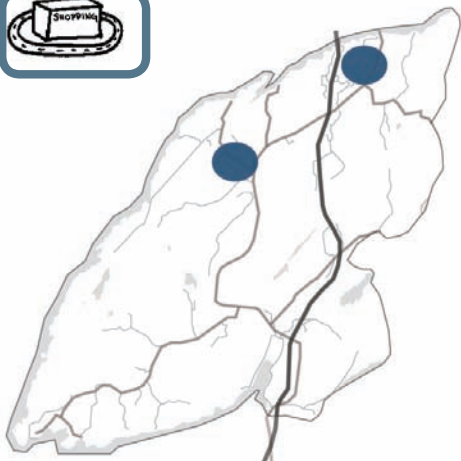


INACCESSIBLE NATURE
The nature around Hogdalsnäset with a lot of biological and educational values is hidden and difficult to access. This problem is mainly encountered at the surroundings of Nordby shopping mall, where there is an unclear connection that keeps nature isolated. Or at the forested area the topography lack of recreational infrastructure and unawareness deprive people to enjoy its ecological values. The problem also occurs in the coastal area, where the topography and the lack of connectivity are contributing factors. In this coastal area there is also a natural reserve, hidden and unknown for the people who visit Hogdalsnäset.

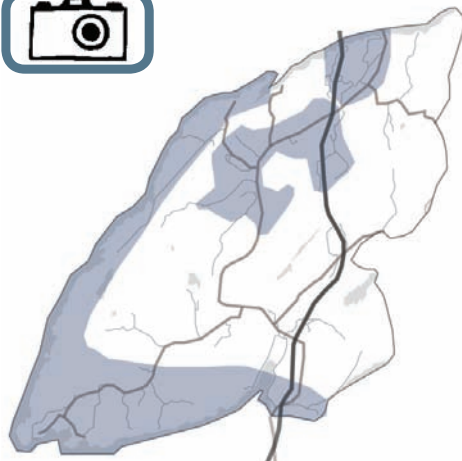


MAP SHOWING ALL CHALLENGES IN CONNECTIVITY
Connectivity problems can be found in a big part of Hogdalsnäset. In Nordby all three challenges occur at once.

CHALLENGES RELATING TO ECONOMIC ACTIVITIES



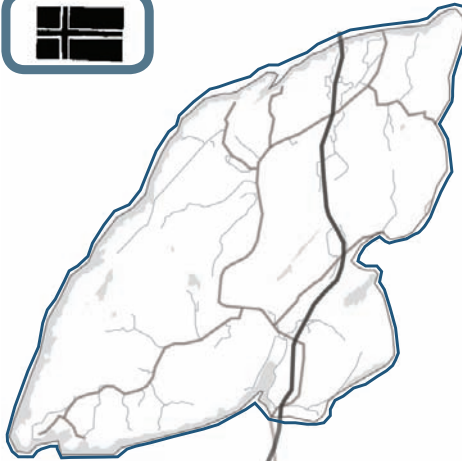
EXTERNAL COMMERCE
Nordby and Svinesund shopping malls are massive infrastructures located in rural areas. These shopping malls supply the whole region, being the main industrial focus in Hogdalsnäset. This results in the death of city cores, as Nordby competes about the costumers with Strömstad, and also it supposes a higher dependence on car use.



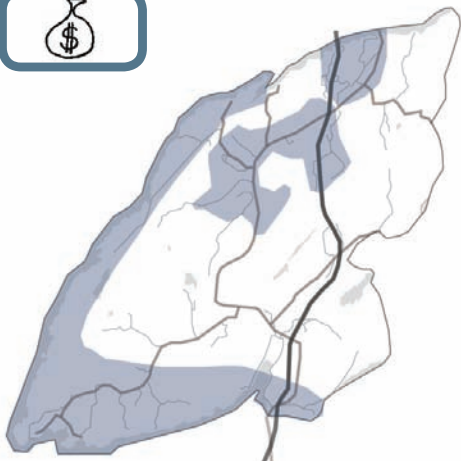
HIGH VALUED TOURISM INDUSTRY
Tourists needs are prioritized over residents needs. An expansion of facilities for tourism are mentioned for this area in the municipalities plans. There are no social meeting points in this area and no permanent services.



SEASONAL POPULATION FLUCTUATION
Hogdalsnäset is known as a summer-holiday place, because of its high natural beauty and the coastline. This supposes a seasonal fluctuation of people and results in empty summer houses and "ghost" campsites at the end of the season. The tax revenue does not reflect the population through out the year and markets are highly dependent on only summer months.



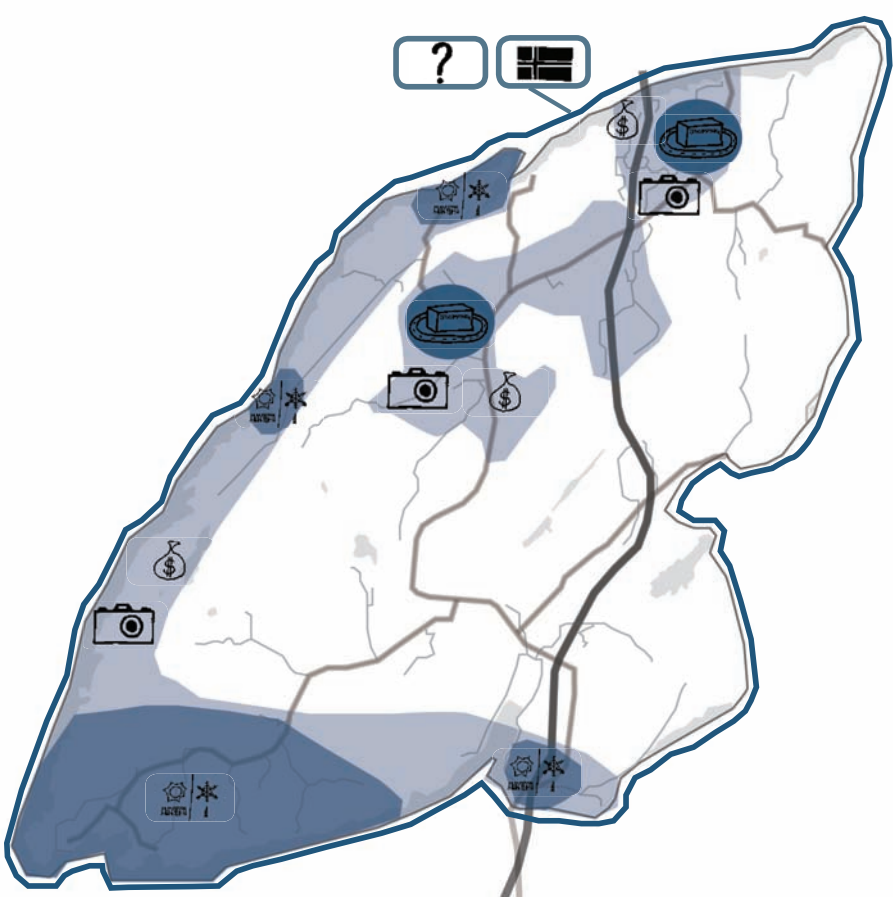
HIGH NORWEGIAN INFLUENCE
Hogdalsnäset is a border area between Norway and Sweden. The economical wealth of Norway makes this border region a perfect spot for Norwegians to buy or live as their economy is stronger than the Swedish, and they commute to Norway to work, taking advantage of the closeness. This situation has a significant social influence as most of the markets are focused to Norwegian tourism and more than half of the settlements are inhabited by Norwegians.



DEPENDANCE ON ONLY TWO INDUSTRIES
Commerce and tourism are the only industries supporting the economy of the area. The dependance on only two industries weakens the functional region and is a risk for economical stability.



LOSS OF IDENTITY
The depletion of agriculture and fishing industry, which were the traditional activities in the area, in exchange for tourism and external commerce suppose a loss of identity at Hogdalsnäset, as the whole region tends to globalization instead of trying to reinforce its own qualities.



MAP SHOWING ALL CHALLENGES RELATING TO ECONOMIC ACTIVITIES IN HOGDALSNÄSET.
The challenges are manly found along the coast and around large tourist attractions but there are also some challenges that affect the larger scale.

CHALLENGES RELATING TO NATURE



CHANGE OF LAND USE

The region experience a change of land use in different ways. The expansion of new shopping malls implies a loss of agricultural or cultural land and a decrease of traditional activities. New infrastructures, the decrease of open land and its natural reforestation causes a loss of important habitats.



FRAGMENTED LANDSCAPE

E6 road and other big infrastructures and local roads, produce fragmentation of habitats with a negative impact on animal populations. The disconnection of habitats blocks the natural migration routes. The increase of border effect reduce the core area of their niches resulting in a loss of habitat for many species. The largest fragmentation effect is found at the island formed between the new and old E6 which include some sensitive habitats.



LACK OF CONSIDERATION REGARDING CULTURAL HERITAGE

Hogdalsnäset includes a lot of high valued cultural remnants that are not taken into account. Nordby and Svinesund shopping malls are built over these special sites and their planned expansion would affect the valuable cultural heritage.



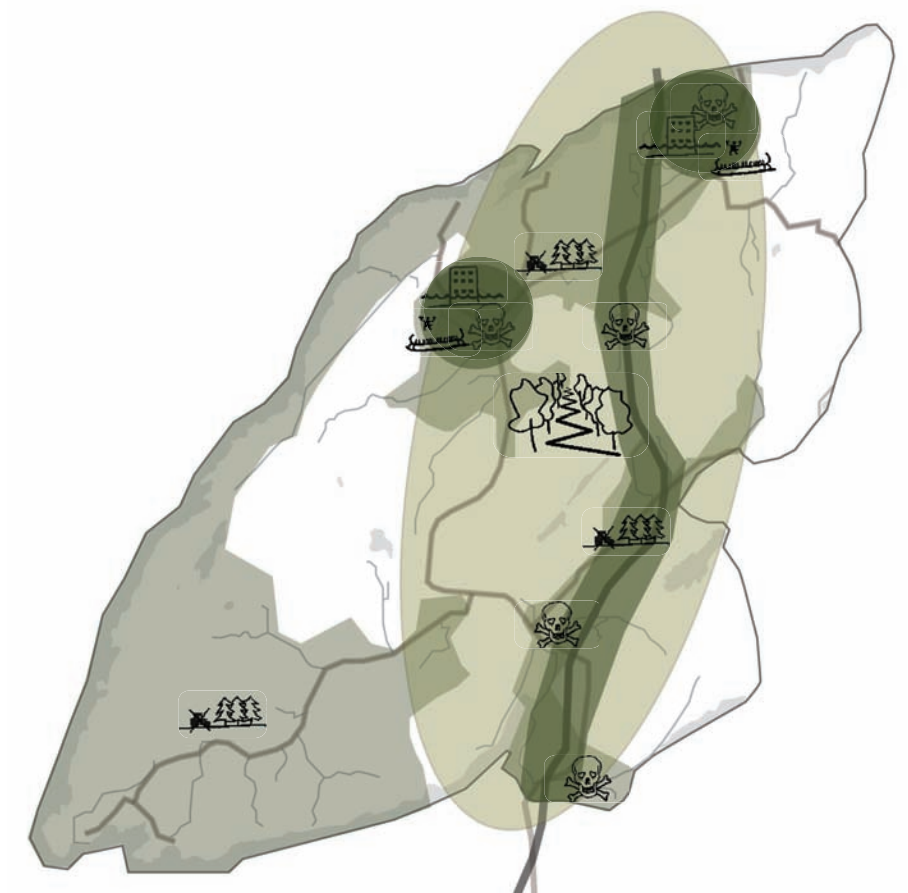
NOISE AND TOXIC POLLUTION

The influence of the road and its heavy traffic affects significantly water resources, habitats and human settlements. Fertilized agricultural practices and paved commercial areas and other areas frequented by people contribute to polluted water and soils and disturb surrounding ecosystems with noise from their activity.



AREAS PRONE TO FLOODING

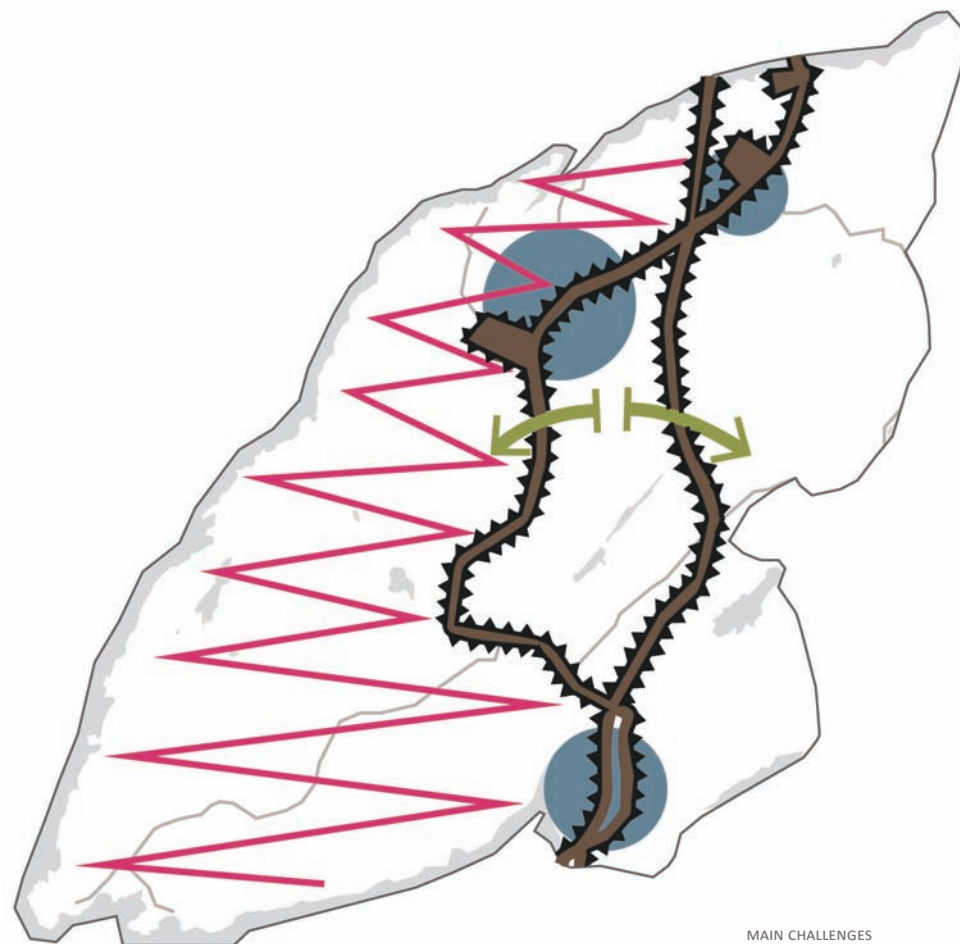
Kobbungsbäcken stream, on its way through Nordby, floods causing important damages to the shopping mall and surrounding areas. This is due to the bad location of the mall, built upon the stream without considering the natural fluctuation on the water discharge. Also, the paved area contributes to a heavier run-off that increase the natural water support to the stream.



MAP SHOWING ALL CHALLENGES RELATING TO NATURE

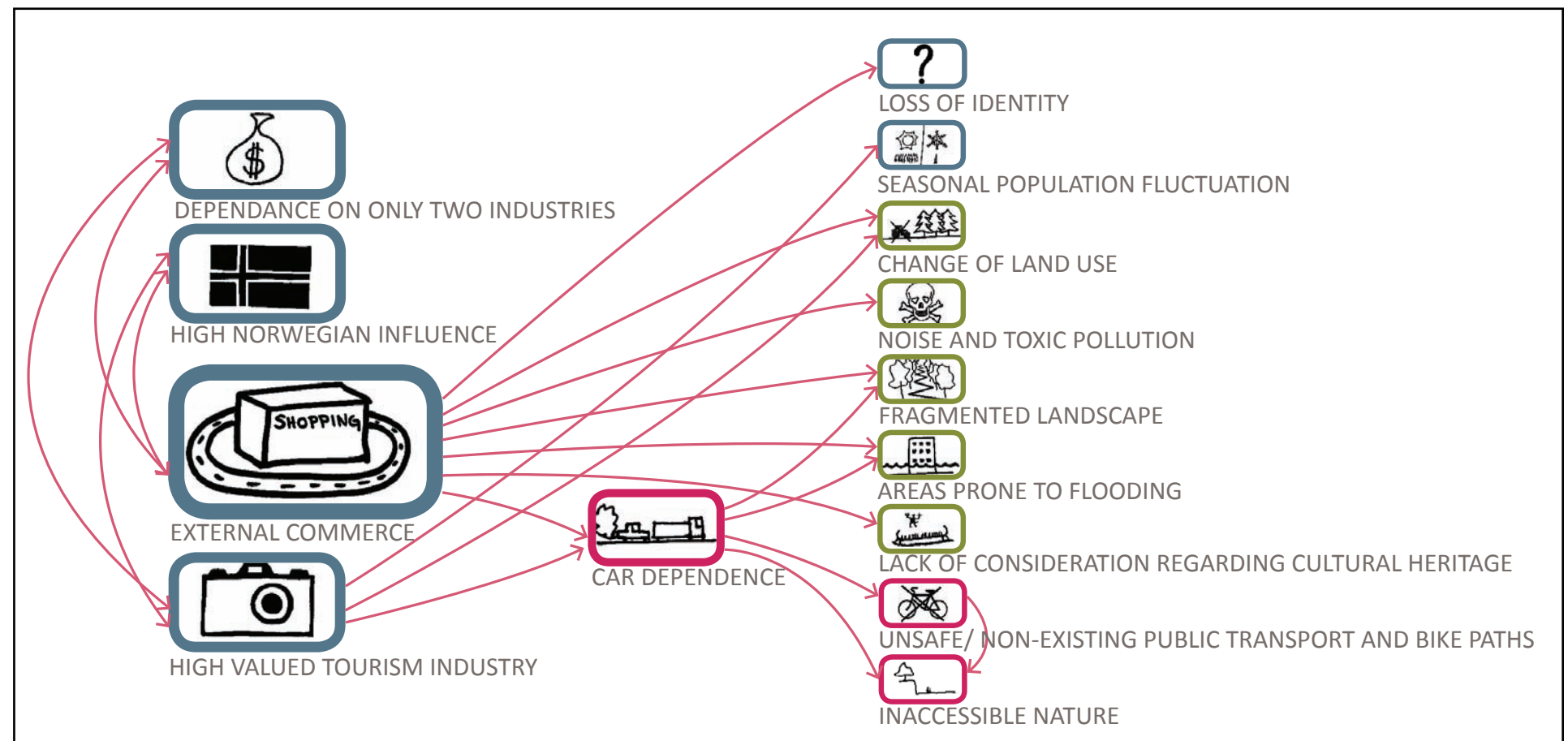
The coast and the agricultural land contains the most sensitive form of nature in the area. Large infrastructures are causing damage to the inland nature.

MAIN CHALLENGES IN HOGDALSNÄSET



MAIN CHALLENGES

- Barrier effect**
Referred to the massive infrastructures which suppose a barrier for animal populations and for humans.
- Disconnection of habitats**
Due to the E6 road, in a bigger scale, that fragments and isolates habitats principally in the island contained between the old and the new road.
- Lack of connectivity**
The linkage between the social Hotspots in Hogdalsnäset is poor due to lack of public paths and transportation. Living in or visiting the area demands car if you are going further than one kilometer away from the old E6. This also implies the disconnection with the surrounding nature.
- Sensitive areas for water**
Referred to areas prone to flooding and to sensitive water bodies threatened by pollution.
- Pollutant leakage**
All around the artificial infrastructures which are the main source of pollutants due to human activity.



COMPLEXITY IN CHALLENGES

INTERPRETATION OF CHALLENGES

Merging the different challenge layers we obtain a combined layout which shows an overview and conclusion for these challenges. This allows us to identify the sites that need more attention and where it would be more essential to act. In the same way, it helps us to relate the different challenges and see the complex linkage between them shown on the complex diagram above to the right.

EXTERNAL SHOPPING MALLS

The engine for most of the challenges is the external shopping malls located in Svinesund and Nordby. They act as barriers for animals and, like other big infrastructures along the area, they generate pollutants that leak out into the surrounding landscape. Their large paved areas ease runoff and, at Nordby, are prone to flooding as this shopping mall has been built over the channel of Kobbungsbacken stream. They foment the development of other infrastructures, as roads, to get to them by car so they don't just enhance fragmentation of habitats but also create a car-dependent region. This car dependence and focus on commerce promotes a one-way flow keeping the attention out of the surrounding landscape and avoiding the development of paths through nature. Due to this, and to the dramatic topography of the area, nature is inaccessible.

HIGH NORWEGIAN INFLUENCE

Hogdalsnäset is a border region, heavily influenced by Norwegians and their purchasing power. Related to this, there is a huge amount of shopping tourism throughout the year.

SEASONAL FLUCTUATION AND DEPENDENCE ON ONLY TWO MARKETS

The coastal area is an attraction that has the biggest amount of tourism during summer months, leaving the place abandoned in other seasons. In summer, not only tourism but commerce activities increases and the high flow of people promote traffic jams where the roads don't meet demand for the amount of people. The lack of diversity of services and the seasonal fluctuation of population forms a closed loop (vicious circle?) that weakens the region leaving it dependent only on these two markets, tourism and commerce.

CHANGE OF LAND USE AND LOSS OF IDENTITY

The change of land use that has been taking place up till now, calls into question the strength of the identity of the region. The main problem is not a lack of identity but the loss of identity of the place what means that, even if the identity is still in the place it is not visible because other structures, as the massive shopping malls, eclipse it.

PROPOSAL

OUR VISION
ALTERNATIVE SOLUTIONS

OUR VISION AND STRATEGIES

Method

From the more specific challenges in this second scale and from the vision for the region as a whole we wrote a vision of how we think this specific area should develop. We have shown how we can use our design strategies from the first scale in this area on simple maps, photo montages and example pictures.

Our approach

This has helped us in finding where to work further on with our design interventions in a smaller scale to strengthen Hogdalsnäset and the region as a whole.

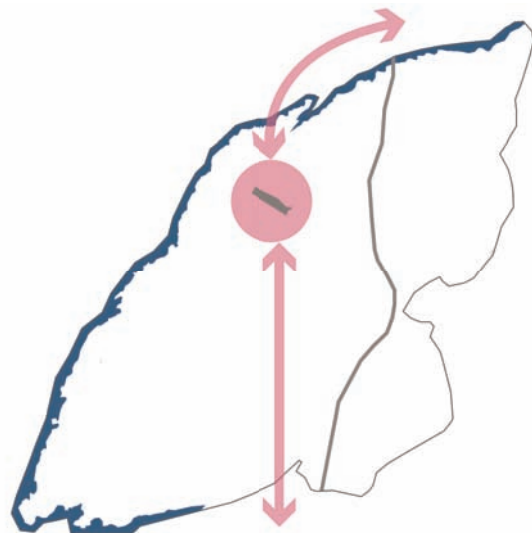
*“OUR VISION IS FOR HOGDALSNÄSET TO DEVELOP AS A RURAL AREA
WITH STRONG IDENTITY BY TAKING ADVANTAGE OF THE CURRENT
SITUATION WITH THE LARGEST SHOPPING MALL IN SWEDEN AND THE
SURROUNDING RURAL LANDSCAPE”*

STRATEGIES

We have proposed how to apply our strategies in Hogdalsnäset to strengthen the area and also connect it to the surroundings. This is an introduction to each strategy that will be described further on the following pages.



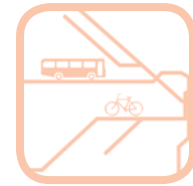
BROADEN SERVICE
DIVERSITY ALL YEAR
AROUND



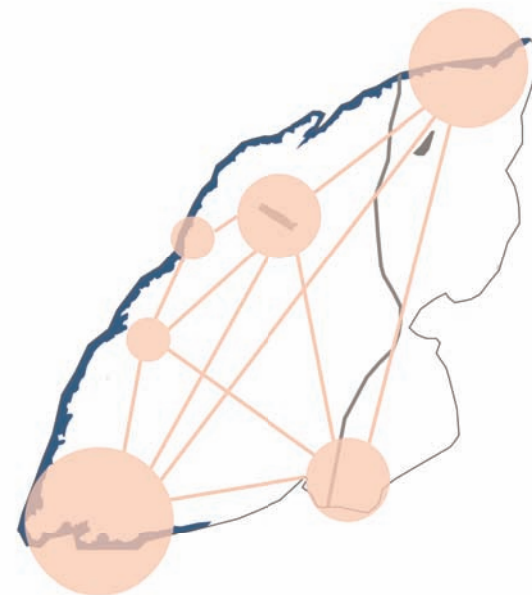
Work for a stronger collaboration between Strömstad and Halden with Nordby as an important meeting point.

Develop a stronger identity built up by the unique nature and the needs and wills of the local people.

Create attractive spot for entrepreneurs where a strengthened connection to Norway and Gothenburg is important.



IMPROVE
CONNECTIVITY



Connect the different social hot spots with safe bike and pedestrian paths to make the area more accessible which can improve the understanding of the landscape.

Creating a stronger alternative connectivity should decrease the car traffic and take some pressure of the roads.

We think it is important to strengthen the correlation between the tourism industry and the nature by creating experience paths to nature.



LESSEN THE BARRIER
EFFECT



Reconnect the habitats to decrease the fragmentation of the landscape and allow wildlife and pedestrians to move more freely through the area.

Lessen the big human impact from large infrastructures on the nature



IMPROVE
WATER QUALITY



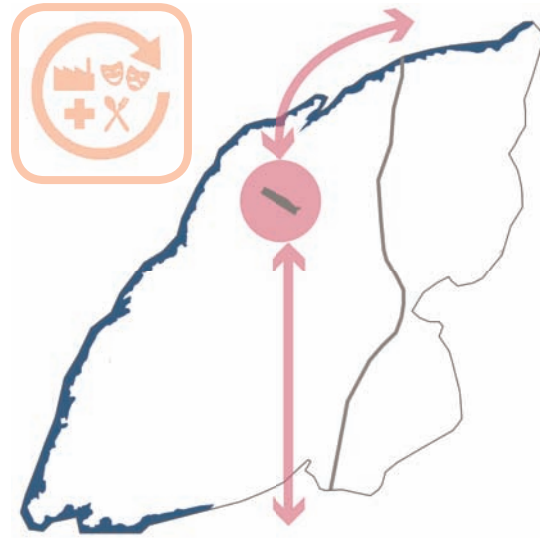
Prevent flooding from damaging infrastructures and allow natural movements of the water by creating water management structures.

Clean waterways and water bodies will contribute to a better quality for nature and for human use.

To help us implement our design strategies we have come up with design keys that will be presented on the following pages. The design keys are different ways to design and also important components for achieving our strategies.

NORDBY AS A HUB

A hub is a centre of activity or interest; a focal point

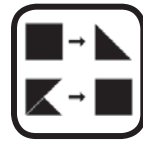


Nordby as a strategic point, in the middle of Strömstad and Halden, with a huge people flow has great potential to develop as a hub. A hub where different transport modes could meet. To make the shopping mall more site specific we propose an establishment of a nature visitor centre. The visitor centre should educate and guide people into the specific nature of Hogdalsnåset. The visitor centre should provide access to nature by foot, bike or bus. The educational part should include information about former and future land use and be a foundation for discussions. Nordby should also provide a place for local entrepreneurship. This could be done by an establishment of an innovation centre including distant learning opportunities. This could in the long run be an answer to the regions lack of people with higher education. The innovation centre should serve as meeting place to strengthen the connections between, primarily, Strömstad and Halden in Norway.

The photo collage shows one example of how Nordby could work as a hub and meeting place with a focus on different transport modes.



DESIGN KEYS



CHANGEABLE AREAS

The future change of land use and external climatic influences need to be considered in every design proposal in order to build resilient. One way is to create designs that are changeable where both the physical form and the uses can emerge over time into something new. The time frame could be short as the change of a parking lot on park(ing)-day or longer as a change from industry to public park Dusiburg.



Park(ing)-day in Chicago Source: Dwellarizona



Source: K. Schachtschneider



LOCAL RECOGNITION

A design proposal that emphasize the site specific qualities will also enhance the identity of the area and have a more sustainable outcome when it comes to natural and social consequences. Local recognition could involve use of local competence and an introduction of the local nature and history. It could also include a careful design disposal of natural site specific conditions.



Source: knstrct



Source: burnham-on-sea



SOCIAL MEETING POINT

A design that generates social interaction is important for social sustainability, especially in this area where we have a large contingent throughput of people. Social interactions could occur through a connection between different interest, where locals and tourist or Norwegians and Swedes naturally meet. It is important to have a diversity of meeting points to provide both planned and spontaneous social interaction.



Source: cumbu



Source: Aucklandfringe



LANDMARK

Prominent identifying features in the design should communicate the overall use and importance of a place. Landmarks should also work to increase the orientability.

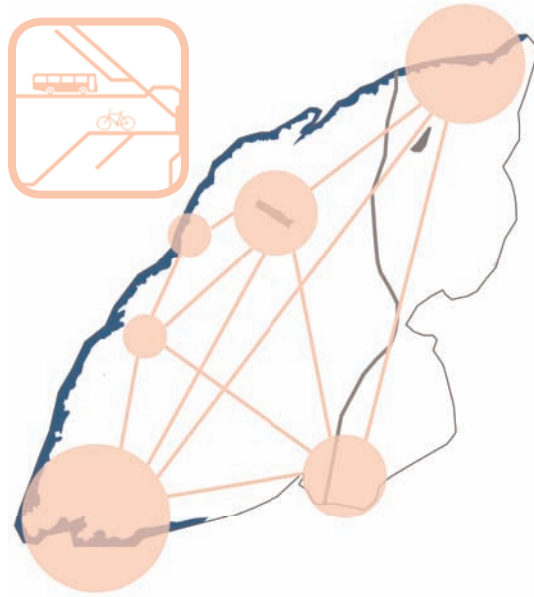


Chicago Source: fauxology



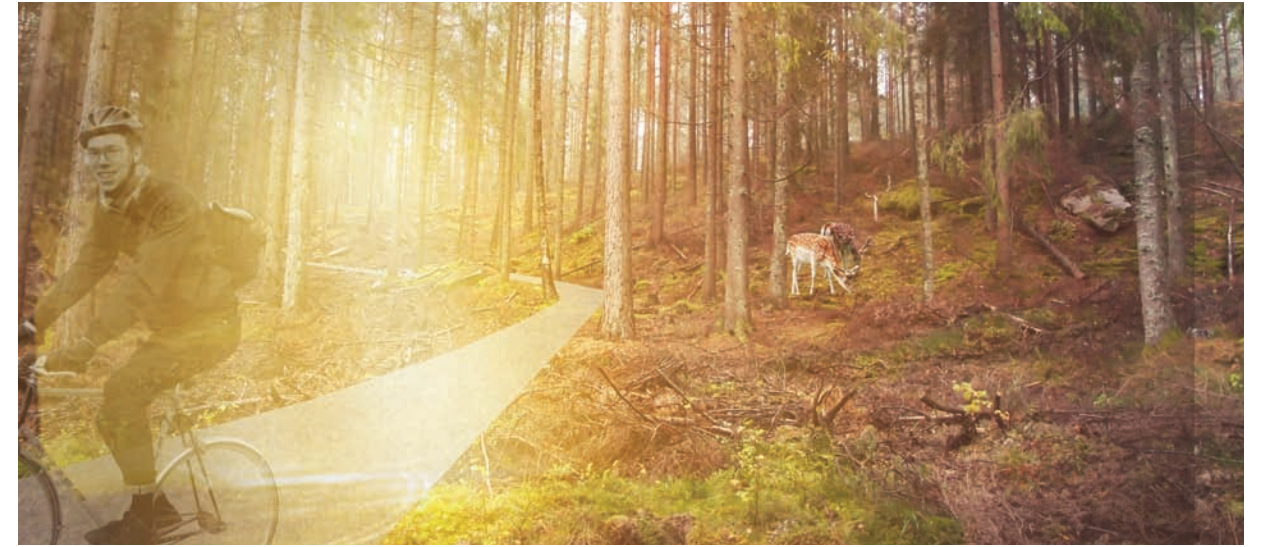
Skogskyrkogården Source: gardenvisit

IMPROVE CONNECTIVITY



The tourism in Strömstad is an important resource bringing many people into the region. Hogdalsnäset is important with shopping tourism creating large flows of people. With a large flow of people there is an opportunity to introduce them to the recreational values in the area and develop the nature tourism. This could only be done with an expansion and improvement of paths and accessibility for tourists and locals. The existing paths need to be extended and linked and new bike connections between the different social hot spots are of interest to strengthen the connectivity. A safe and separated bike path should also be added along the bigger roads to provide a healthier and alternative way of commuting from Hogdalsnäset to Norway or Strömstad. The bike paths can be connected with already existing paths in Norway leading all the way to Halden.

The photo collage to the right shows one example of how paths through could strengthen the accessibility to and experience of nature.



DESIGN KEYS



FAST TRANSPORTATION

The improvement of connectivity for this specific area includes fast transportation network for commuters and people travelling from point A to point B in the landscape. This structure need to be designed to reach the possible fastest and most safety solution. The experience of the landscape when travelling in the fast network need to be considered. This could be done....



Source: streetsblog

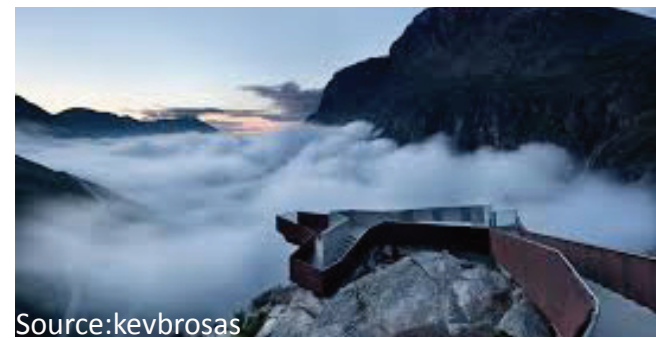


Source: streetsblog



EXPERIENCE ROUTES

As opposed to the fast transportation the connectivity also need to provide a network for slow moving transportation with a focus on experiences. The experience routes should connect different hot spots and lead people to easily discover new areas. This could be done by paths used by bikers, pedestrians and horse riders leading through different landscape types. The paths should be designed to enhance the experience of the landscape and the history with as little impact on existing nature as possible.



Source:kevbrosas

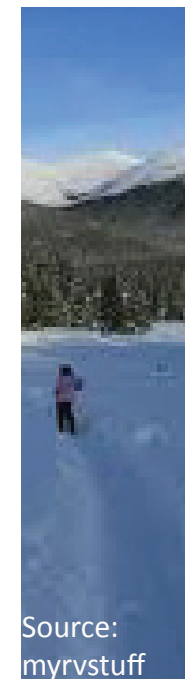


Source:treklocation

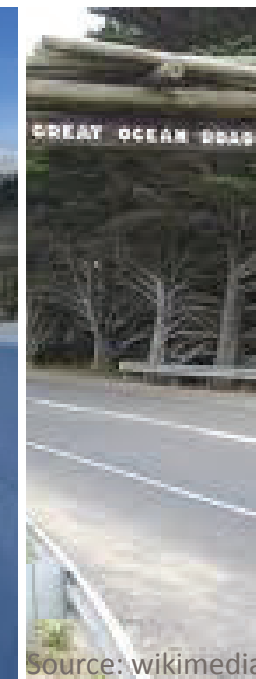


ORIENTATION

The connectivity network should help the visitor to both experience the surroundings but also to orientate itself in the landscape. The more interests, activities and connectivity in a place the higher need for a distinct orientation. The design of pathways and roads could help the legibility of a place. Appearance, width and location of paths and roads are helpful measurement to indicate the hierarchy in the road network.



Source: myrvstuff



Source: wikimedia

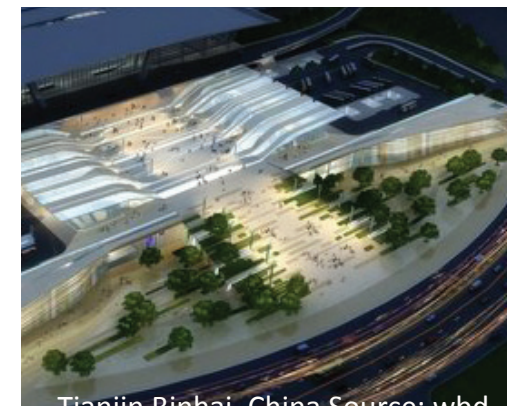


Source: pinterest



NODE

In places where the road and/or path network meet a node appears. Nodes are important to facilitate easy changes between different transport modes but also to provide social interaction and cultural exchange. A node could be at a large scale as a central station or a small scale service area.



Tianjin Binhai, China Source: wbd



Source: spf

LESSEN THE BARRIER EFFECT

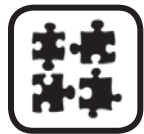


By supporting a natural movement of species and healthy water ways the high nature values can be sustained and shown in order to deepen peoples' understanding for the area. Hogdalsnäset is one of the areas in Bohuslän that has the most unexploited nature including the coast line. We believe this is giving the area a unique quality that should be enhanced but also protected. New development should take great consideration towards the nature and human-nature interactions should be designed with as little impact on nature as possible.

The photo collage on the right shows one example of how a ecoduct could be used over the E6 to reconnect habitats.



DESIGN KEYS



RECONNECT HABITATS

Fragmentation of habitats occur frequently in different scales. A design with a consideration of species movements and natural flows could improve the current situation. This could be done by eg. ecoducts, ecotunnels, stepping stones and corridors.



Eco tunnel Source: infrabel



Source: arc-solution



Ecoduct Source: livegreen blog



CONNECT HUMAN WITH NATURE

The unique nature and natural processes are not always visible. A careful design of those areas where humans interact with nature could increase the understanding of the area. Access to nature need to be designed with as little negative impact on nature as possible. A design proposal could also provide different level of interaction, from planned educational to experimental and spiritual.



Source: tbg



Source: japan-guide



Source: nps



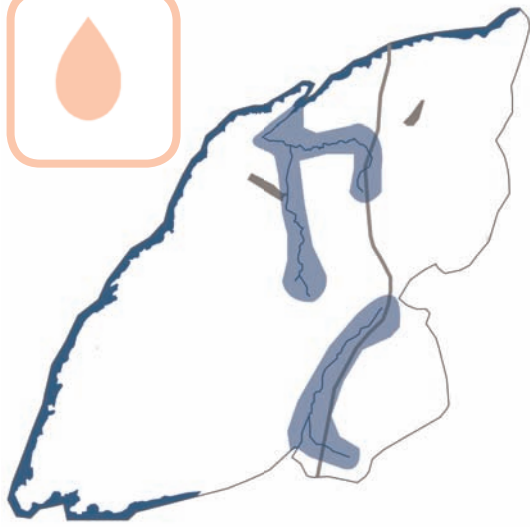
PREPARATION FOR CHANGE

Changes occurs constantly in the landscape and by a vast knowledge of natural processes the design could consider future challenges. An example could be buffer zones preventing invasive species to strike native habitats or flood plains allowing future increase in precipitation.



Source: wikipedia

IMPROVE WATER QUALITY



Hogdalsnäset holds many water bodies that direct or indirect are affected by the larger roads and the paved areas at Nordby and Svinesund shopping mall. The impact of, mainly, Nordby shopping mall should be decreased with a conversion from hard surfaces to impermeable surfaces. The water in the river Kobbungsbäcken and Hogdalsbäcken is polluted and need to be treated to counter toxic infiltration and flooding.

The photo collage on the right shows one example of how a constructed wetland could function not only for water treatment but also for recreational and educational purposes.



DESIGN KEYS



WATER TREATMENT

Problems and challenges relating to water such as, polluted waterways and flooding could be treated through a designed management. Examples of water treatment could be sedimentation basins, rain gardens, swales and wetlands. A water treatment could also include a reestablishment of the natural floodplain allowing the river or flood to natural meander.



Source: H2oncoast



Red Ribbon Park, China Source: contemporist



EDUCATIONAL WATER PROCESS

Water is an important feature in the landscape and can explain the structure of the landscape and natural changes. Water areas can with the right design visualize natural processes and movements of water and thereby educate visitors. Additional information stations and signs could help the visitor understand water as an element.



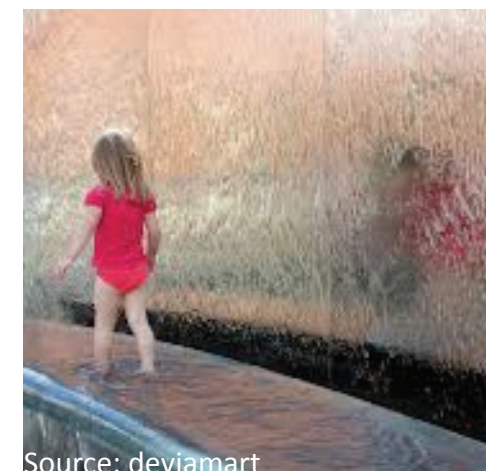
Source: valigirls

Source: unl

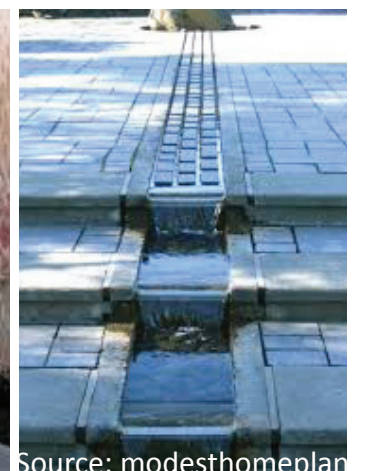


WATER AS AN EXPERIENTIAL FEATURE

Water is a strong element that distinguish itself from the more solid earth. Water is said to have a calming effect on humans. To experience water in a controlled or natural environment could have a recreational purpose. The design of waterways can also provide human interaction with water in a playful way using the different senses. Water features could also serve as an attraction gathering people and providing social interactions.



Source: deviamart



Source: modesthomeplan

DETERMINATION OF THIRD SCALE

DETERMINATION OF THIRD SCALE

Method

After all the study made in previous chapters we conclude with Nordby as the most challenging site to work with. We showed its location in a Hogdalsnäset map and then explained the reasons why it is an important spot in the region and for us to develop our design strategies.

Finally, we discussed the External Shopping malls as a phenomenon in three different levels: global, local and our personal judgement.

Our approach

With the study of Nordby shopping mall in this third scale, we wanted to explore the possibilities of external shopping malls to be developed in a more complex and sustainable way, taking advantage of the power of commerce to make a more convivial environment out of it.



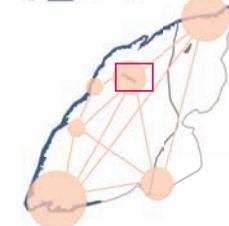
NORDBY FOR FURTHER STUDIES

For our third scale we have chosen to work with Nordby. This is where we found most of the challenges but also many opportunities. Nordby is the biggest attraction in Hogdalsnäset with 7 million visitors every year, this gives the place great potential for development that would help improve Hogdalsnäset and the region as a whole.

HOW A DEVELOPMENT OF HOGDALSNÄSET IS POSSIBLE BY IMPLEMENTING STRATEGIES IN NORDBY:



Nordby can work as an important Hub in the region where entrepreneurs can establish and spontaneous meetings can occur.



With Nordby as a node where different transportation meet it would be easy to change between transport modes to get around in the region.



By working with the fragmentation that Nordby implies we could reconnect habitats and make the natural processes more visible to enhance the understanding for the surrounding nature.



Water treatment around Nordby would decrease the many pollutants leaking out to the surrounding nature and Kobbungsbäcken and further on to Idefjorden and the Sea.

EXTERNAL SHOPPING AS A PHENOMENON

Nordby is also interesting in a broader perspective, since it is a part of the global phenomenon with establishment of external commerce.

GLOBAL PHENOMENON

External shopping is a phenomenon in the whole world where a large amount of large scale shopping malls are built every year. The malls look almost the same everywhere and they take a lot of land in to account. The external commerce are mostly located in rural areas and they there for relies on people to use there cars. Big paved areas and an increased amount of car use result in pollutants and fragmentation of the landscape. The external commerce also result in dying city cores when people choose them instead of the town centre for their shopping.

LOCAL PHENOMENON AND THE CLOSENESS TO NORWAY

In Sweden we have many external shopping malls while they in Norway have special regulations that does not allow external shopping to avoid dying city cores and other negative impacts (Soros, 1013). This is one of the most obvious reasons for the Norwegians to buy land and build a shopping mall on the Swedish side. Another one is of course the prices, the Norwegian krone is stronger than the Swedish one and Norway also have higher taxes on liquor, tobacco, sugar and meat which they then come to the Swedish side to buy.

WE BELIEVE

By working with Nordby we hope to set an example of how these none site specific malls could be developed in a more sustainable way. That said we do not support development of external commerce, but we believe that the already exciting ones could be greatly improved to lessen the negative impact they lead to.

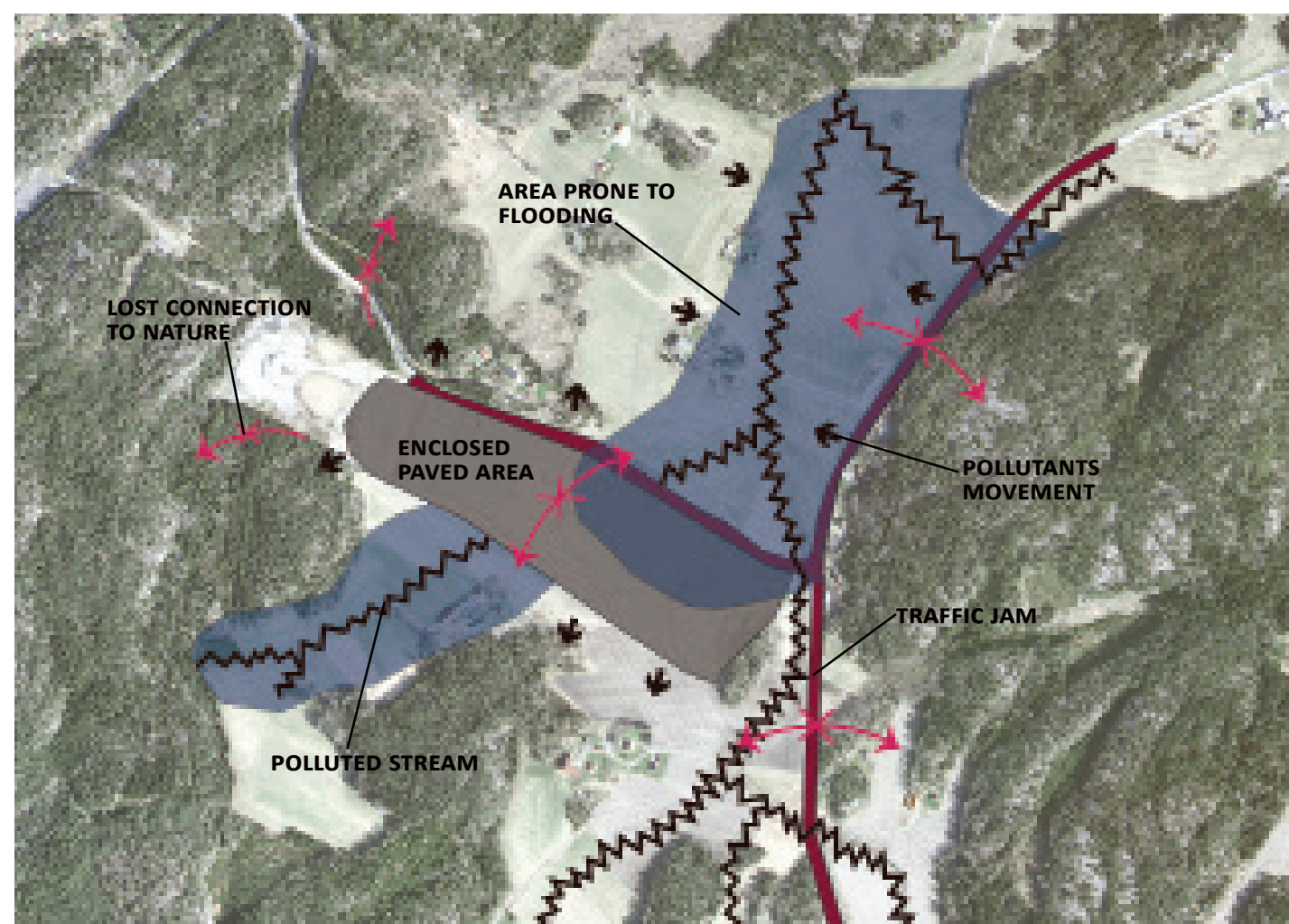


ANALYSIS

CHALLENGES AND IMPROVEMENTS



CHALLENGES IN NORDBY



ENVIRONMENTAL CHALLENGES

Hard surfaces are a barrier for natural flows, it prevents infiltration and contribute to polluted water runoff. Arable land is facing a change in land use and cultural remnants are dismissed in favour of an expansion of commerce.



CHALLENGES WITHIN ECONOMIC ACTIVITIES

The shopping mall instigates the dependency in one market and attract Norwegians. The other unique values in the area are at risk and the identity is attenuated.

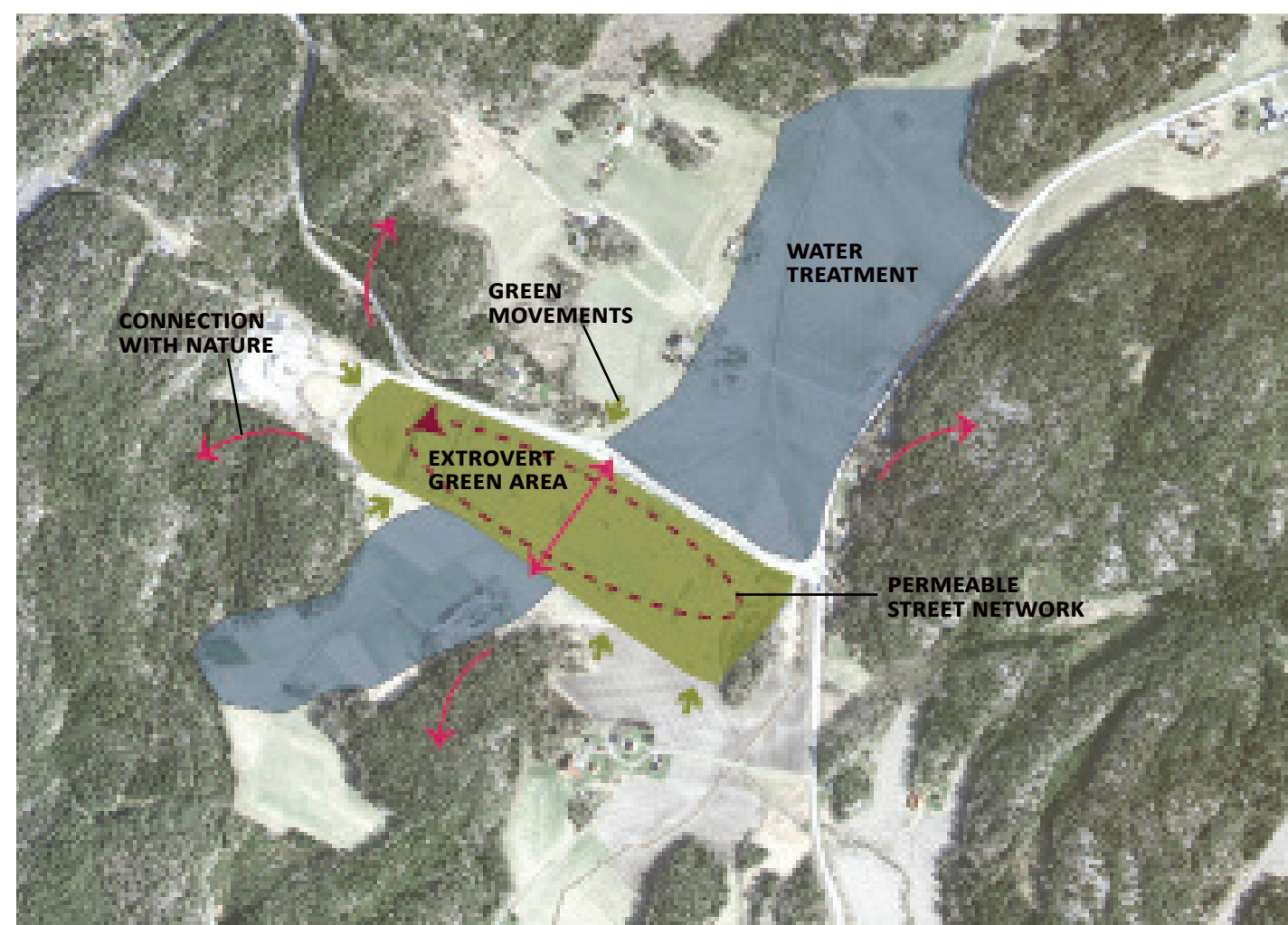


CONNECTIVITY CHALLENGES

The insufficient infrastructure generate large problems with traffic jams. The opportunity to explore the area is low due to lack of a diverse transport system and orientation.

More description about the different challenges is to be found at page 77-79

IMPORTANT IMPROVMENTS



ALTERNATIVES

DEVELOPMENT ALTERNATIVES
OUR MASTERPLAN

DEVELOPMENT ALTERNATIVES FOR NORDBY

THE NO DEVELOPMENT PLAN

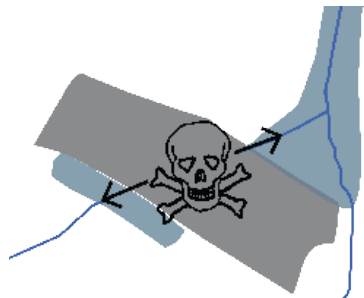


CHALLENGES STILL PRESENT
More description about the different challenges is to be found at page 77-79

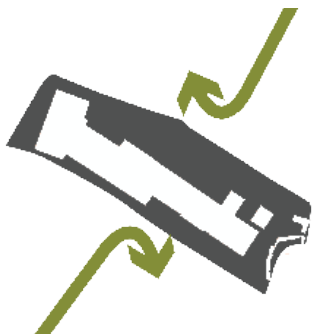
ALTERNATIVE 1: THE COMMERCE IS ONGOING

If the strong economic purchasing power is stable the mall could stay as it is keeping its economic benefits and many work opportunities.

The current traffic stockings and the flooding would still occur and pollutants would keep leaking out to the surrounding nature and water bodies. The critical part of pollutants in the streams is when it ends up in the sensitive fjord habitats which are at risk of getting permanently damaged.



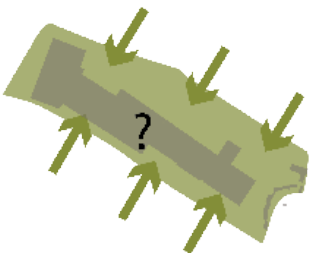
The hard surfaces will continue being a large barrier for surrounding nature.



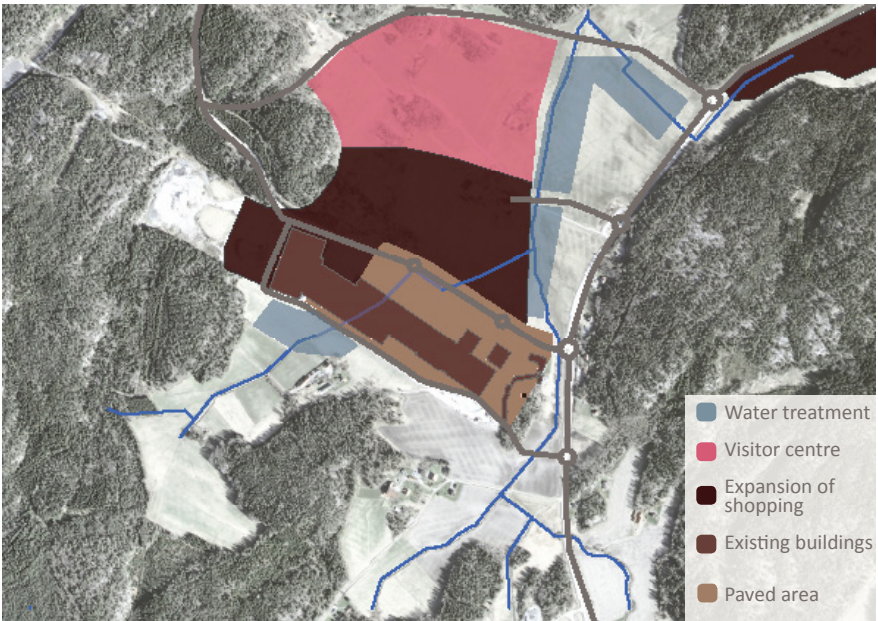
Alternative 2: Nordby is abandoned

The lack of local anchored businesses and site specific design leaves the shopping mall looking very much like other malls and it could easy be replaced by the increasing amount of new shopping malls in the area. This and the decreasing Norwegian krone means that the risk of abandonment of the site is imminent. An abandonment of the mall would leave many people without employment and the area would start to be overgrown, meaning new habitats but also a wound in the visual landscape.

The in time dilapidated buildings would probably be inhabited by flora and fauna and be a health risk for both animals and humans passing through.



STRÖMSTAD MUNICIPALITIES PLAN FOR NORDBY

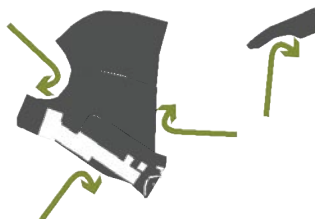


CHALLENGES STILL PRESENT

ALTERNATIVE 1: THE COMMERCE IS ONGOING

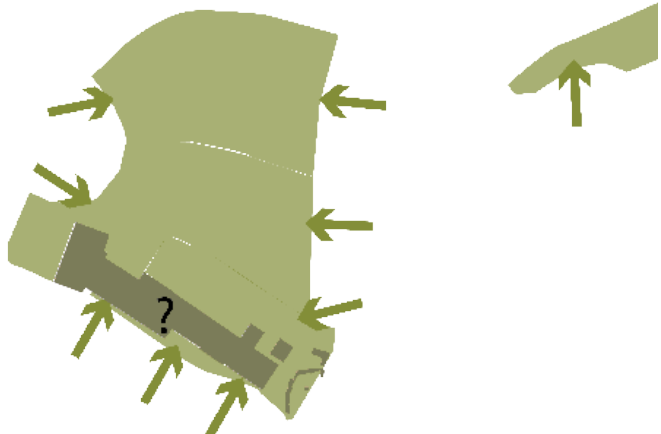
Strömstad municipality describe, in the deepened plan for Nordby, how an expansion of the shopping mall is planned. The expansion would have a huge impact on the visual landscape as well as it would minimize the possible usage of agricultural land and the ability to provide local produced food in the future. The municipality plan for water restoration and constructed wetlands which would improve the water quality and lessen the risk for flooding in the future. They have also proposed a solution for the challenges of the traffic jams by adding new roundabouts. There is also a plan to add a visitor centre that would focus on guidance to the surrounding nature. This would mean a broader diversity of usage and would decrease the economic vulnerability.

The development plan will increase the amount of hard surfaces and natural flows would still be disconnected.



ALTERNATIVE 2: IF NORDBY IS ABANDONED

If the Norwegian krone would drop after the expansion this would leave a large paved area and shopping mall to take care of in the future. The large buildings would be unsuitable for any other usage than industries. If alternative transportation have not been developed it could lead to an isolation of the massive shopping mall with a future decrease of car use due to peak oil.



MASTERPLAN OUR ALTERNATIVE

In Nordby we have three goals for a more resilient development of the external shopping mall. These goals relates to our over all regional strategies which are described below. The masterplan is to be read as a zoning plan where suitable areas had been pointed out. The exact position and design will be described further in our individual proposal at the end of this chapter.

CHALLENGES STILL PRESENT



REGIONAL STRATEGIES APPLIED IN NORDBY



BROADEN SERVICE
DIVERSITY ALL YEAR
AROUND



BRING DOWN SCALE
AND ACCOMMODATE
DIFFERENT FUNCTIONS

By adding small scale houses we can make the area more permeable and create more public spaces in different scales. The visitor centre allows local values and firms to be highlighted.

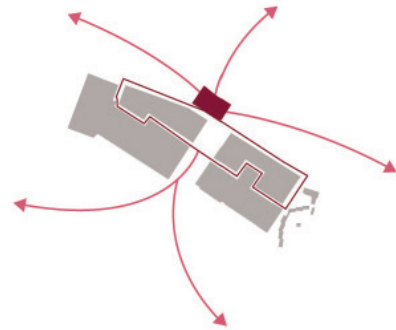


EXTENDING PUBLIC
TRANSPORT AND BIKE
PATHS



FACILITATE A PERMEABLE
NETWORK FOR
MORE ECO-FRIENDLY
TRANSPORTATION

The transport station is the node from where you access the surroundings. The site itself gets more accessible by the new circular jump-on-off tram.



LESSEN THE BARRIER
EFFECTS

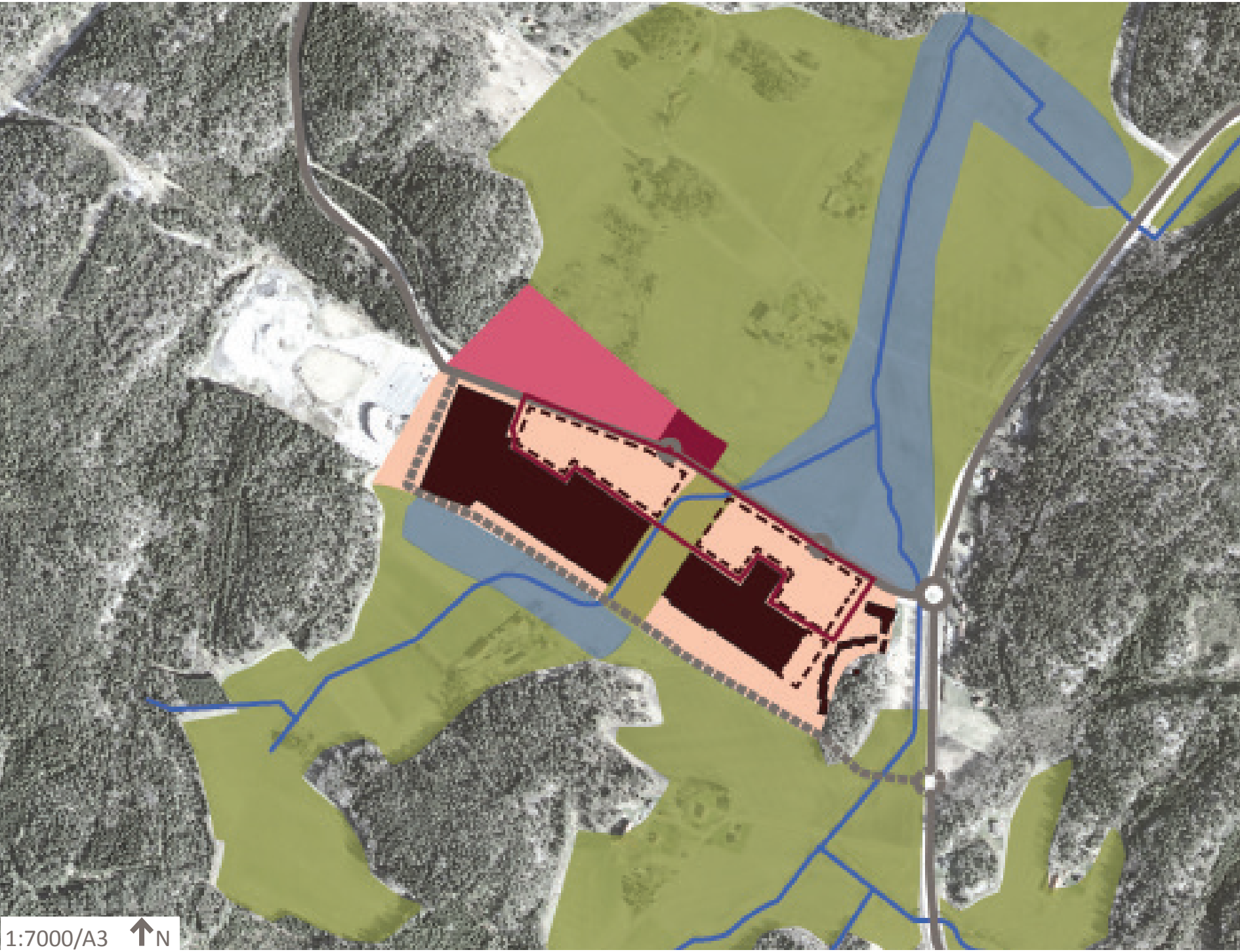
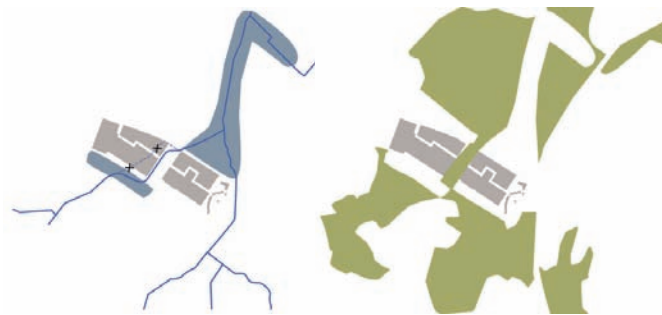


CHANGING FROM
AN INTROVERT TO
EXTROVERT SHOPPING
AREA



WATER MANAGEMENT

By letting nature and natural processes take a greater place the shopping mall can turn into a more environmentally and people friendly place.



Arable land or valuable land to keep open and maintained

Water treatment

Visitor centre

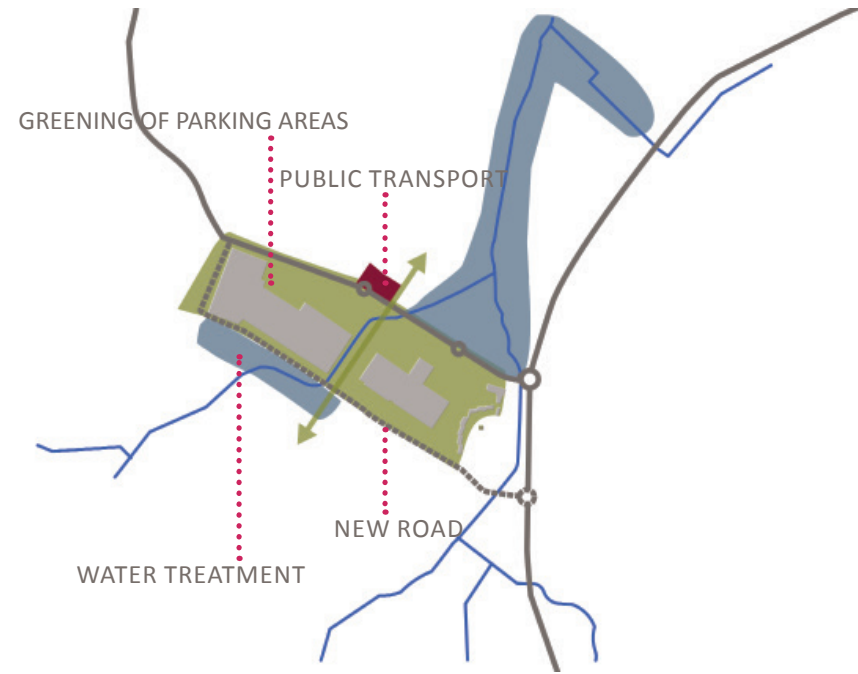
Existing buildings

Public space

Land for building of new small scale houses

OUR PROPOSED DEVELOPMENT OVER TIME

Our strategy is a staged development of Nordby. We expect to introduce the shopping mall into a more sustainable and environmental-friendly ambience within 30 years. The development must be staged for the area to be able to adapt to changes. Moreover, we want to be prepared to the uncertainty of the future climate change and economical-growth direction by making a flexible design.



FIRST STAGE: YEAR 1 - 5

GREENING OF PARKING AREAS

A new green and public structure will be the foundation for a future sustainable and resilient development of the shopping mall. Taking away one of the larger block building will allow Kobbungsbäcken to run freely on the surface. This will also contribute to a natural flow of flora, fauna and visitors through the area.

WATER TREATMENT

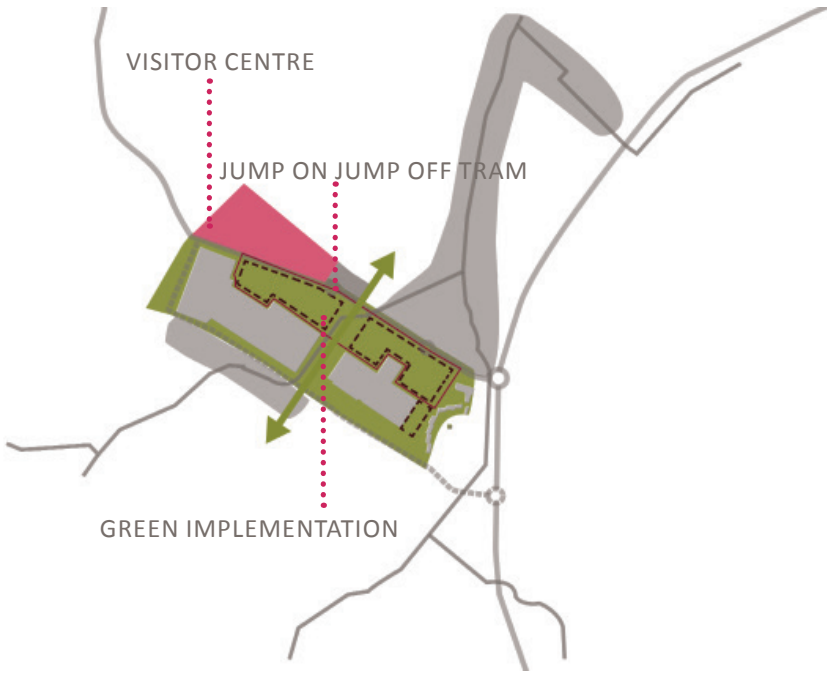
In order to treat polluted water ways and prevent flooding a new wetland park will be established.

PUBLIC TRANSPORT IMPROVEMENT

A new public transport station will encourage innovative and sustainable transportation and reduce car dependency. In the first stage the station will serve for bus and bicycle exchange.

NEW ROAD

A new road will be built south of the shopping mall to reduce the pressure on the road and avoid traffic jams.



SECOND STAGE: YEAR 5 - 30

DEVELOPMENT OF A VISITOR CENTER

The new visitor centre will serve as an information and education centre. It will help to promote local importance and identity.

SUSTAINABLE GREEN INFRASTRUCTURE IMPLEMENTATION

In order to bring down the scale and facilitate different use new lower buildings will be added. Focus will be on new public areas and further green implementation such as green walls and roofs.

PUBLIC TRANSPORT IMPROVEMENT

We believe that the way of transportation has changed dramatically to more sustainable alternatives and public transport. The station is now a public transport hub with different alternatives and facilities. The connection to Norway is now improved and you can easily travel by different public transport between Sweden and Norway. A new jump on-jump off tram goes around Nordby for easy access to all parts.



THIRD STAGE: YEAR 30 -

NORDBY AS A SUSTAINABLE AND RESILIENT HUB

Thirty years later Nordby will be in a stage where it can handle possible changes in world economy, climate change and change of land use. Nature will be embedded within the paved areas which will be multifunctional and dynamic. The surrounding land could be used for local sustainable farming and with plantations for energy supply.

INDIVIDUAL DESIGN PROPOSALS

WETLAND PARK PATRICIA RULL

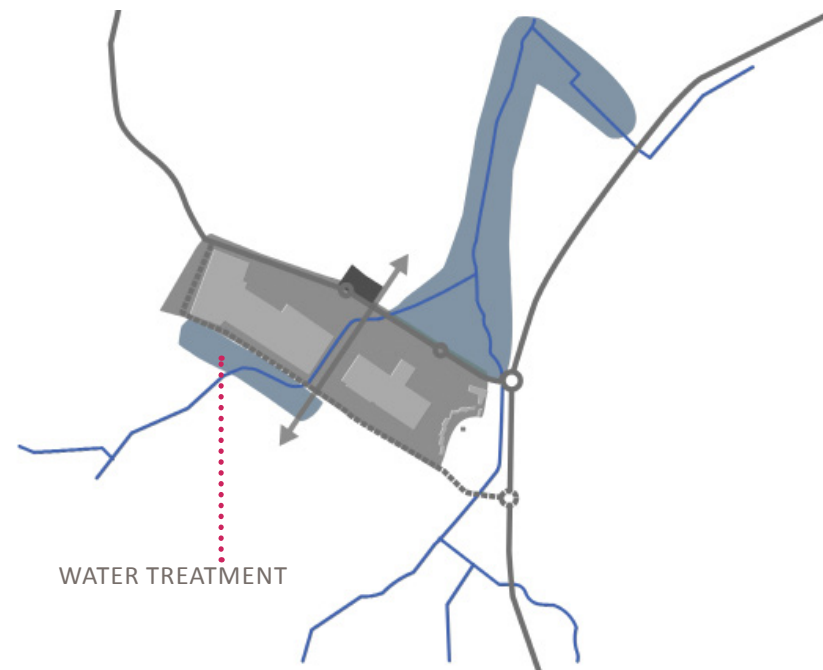
NORDBY PARKING MALIN WINBLAD

NORDBY - MORE THAN A MALL JANNICA LINDÉN

VISITOR CENTRE MARIA BERGVALL

WETLAND PARK PATRICIA RULL

FIRST STAGE
YEAR 1-5



PROPOSAL STRUCTURE

The Wetland Park proposal is divided into two sections, corresponding to a more general approach and a more detailed approach, respectively.

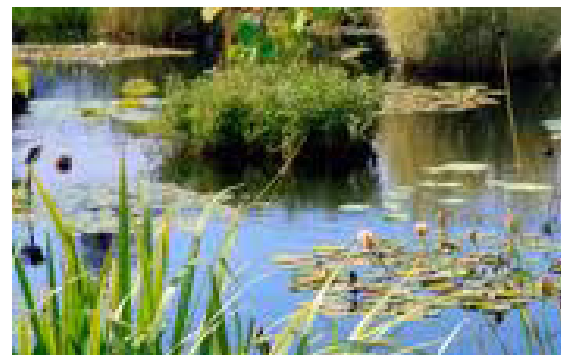
Part 1- In this section, the Wetland Park proposal will be introduced as well as the ideas which motivate its construction. A rough draft, based on an initial approach, will also show different design considerations.

Part 2- In the second section, the problems detected will be addressed in a more detailed insight, with the appropriate changes and considerations made after an in-depth study of the solutions.

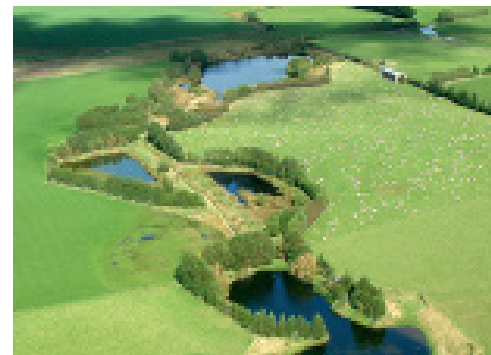
- PART 1 -
WETLAND PARK
GENERAL APPROACH

WETLAND PARK

Constructed wetlands are man-made areas in which physical, chemical and biological processes happen in a controlled manner. The aim is the pollutant removal in a similar way as in natural wetlands. Constructed wetlands are depuration systems formed by shallow ponds or channels (less than 1 m deep) covered by wetland vegetation and in where purification processes take place by means of interactions between water, microorganisms, vegetation, animals and solid substrate which support vegetation and allow the fixation of bacterian biofilms, that are responsible of most of the pollutant removal processes. (Joan García Serrano and Angélica Corzo Hernández nd)



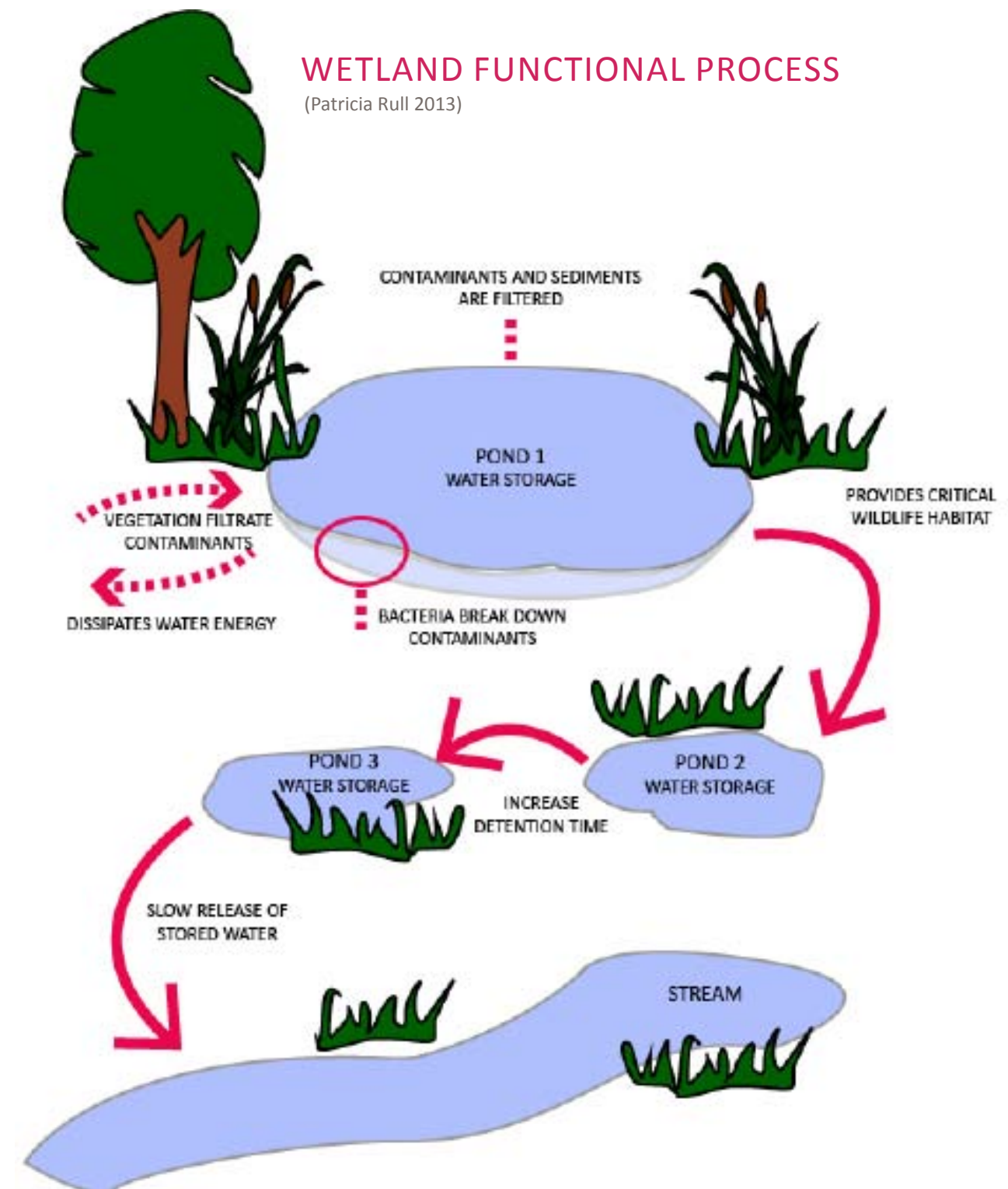
Wetland pond



Wetland park



Vegetation in wetland pond

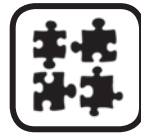


DESIGN KEYS



Water Treatment

By the use of sedimentation ponds and vegetation corridors to control pollution which is damaging sensitive habitats as well as to prevent flooding damage.



Reconnect habitats

The vegetation corridor acts like a bridge that connects forested patches. It also creates new stepping stones which help to connect wildlife. Kobbungsbäcken stream re-naturalization offers also the possibility to enhance its ecological values and to facilitate upstream-downstream connectivity.



Educational water process

By the use of informative signboards it is possible to show people the importance of water natural flows and its ecosystem services.



Water as an experiential feature

Using flooding as a part of the design to demonstrate and experience water natural processes. That can be achieved by making visible flooding and giving freedom to natural flow movements. As well, water variability in the wetland ponds throughout the year is an interesting experiential feature.



Connect human with nature

Making nature more accessible and close by establishing the wetland park in order to approach people to natural processes.



Experience routes

By the establishment of recreational paths within the wetland park and connected out to the surrounding nature.

WETLAND PARK IN NORDBY

- WATER QUALITY IMPROVEMENT:

Nordby paved areas, roads and agricultural land activity produce a huge amount of pollutants which lead to Kobbungsbäcken stream threatening its natural values.

Solution: Wetland ponds allow natural processes. Using bacteria and sunlight, pollutants are broken down before the water eventually flows into downstream watercourses. Vegetation buffer zone is also protector from contamination since it is filtering pollutants. (Nibusinessinfo.co.ku nd)



Pollution at Kobbungsbäcken

- FLOODING CONTROL:

Nordby shopping mall and its surrounding land is affected by flooding. This is mainly due to the shopping mall has being built upon Kobbungsbäcken stream. It disrupt its natural variability of water discharge. In addition the paved areas increase the effect producing a higher amount of run-off.

Solution: Wetlands intercept surface runoff and store stormwater changing rapid and maximum flows into slower and lower discharges for a longer time. (Setena nd)



Flooding

- BIODIVERSITY AND HABITAT CREATION:

The actual conditions of the area do not allow the development of stable wildlife communities due to the disconnected nature patches, polluted soil and water, the artificialization of the waterways and the lack of a continuous vegetation corridor along the stream.

Solution: Wetlands hold a great diversity of species, many of which are rare and unique. It allows the reconnection of the area with nature, connecting sporadic patches by corridors and creating proper conditions for the development of wildlife communities which have an important ecological role in the preservation of the ecosystem.



Askemyr forest in Hogdalsnäset

- AESTHETIC AND RECREATIONAL VALUES:

Nordby area contains a hidden and high valued nature found even beside the shopping mall. Built infrastructure for commerce and transport left behind these unique values.

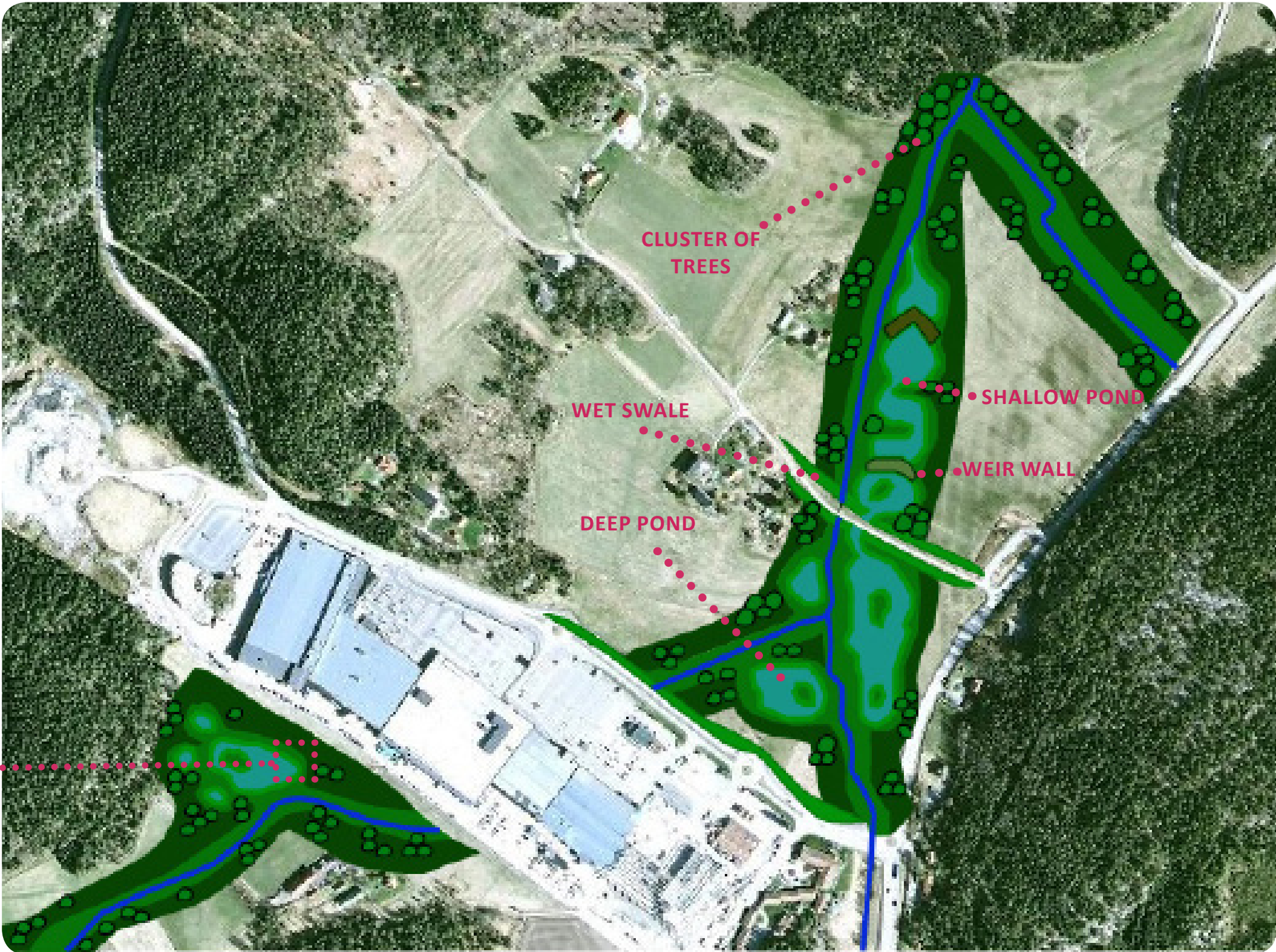
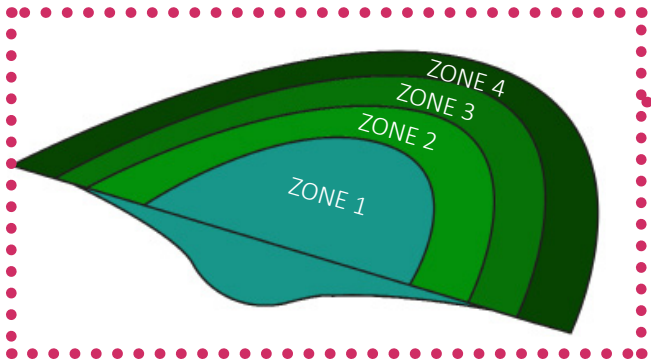
Solution: A wetland park offers the opportunity to develop experience routes within and outside the park for recreation and nature observation. At the same time, its own structure is a valuable aesthetic element which can bring lost sense of place to Nordby and provide educational values.



Natural Reserve in Hogdalsnäset

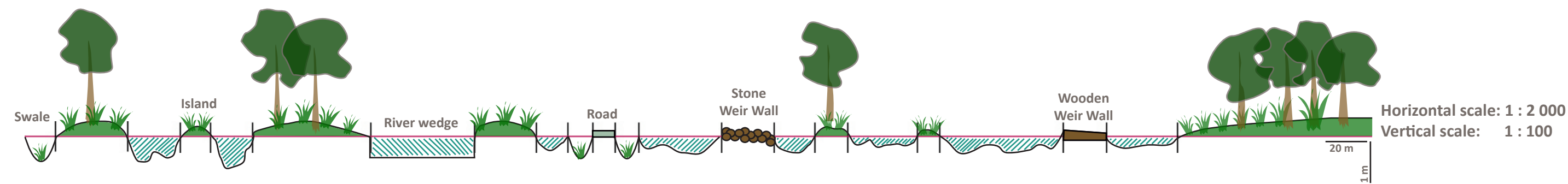
WETLAND PARK OVERVIEW MAP

PLANT ZONATION ALONG A WATER DEPTH GRADIENT

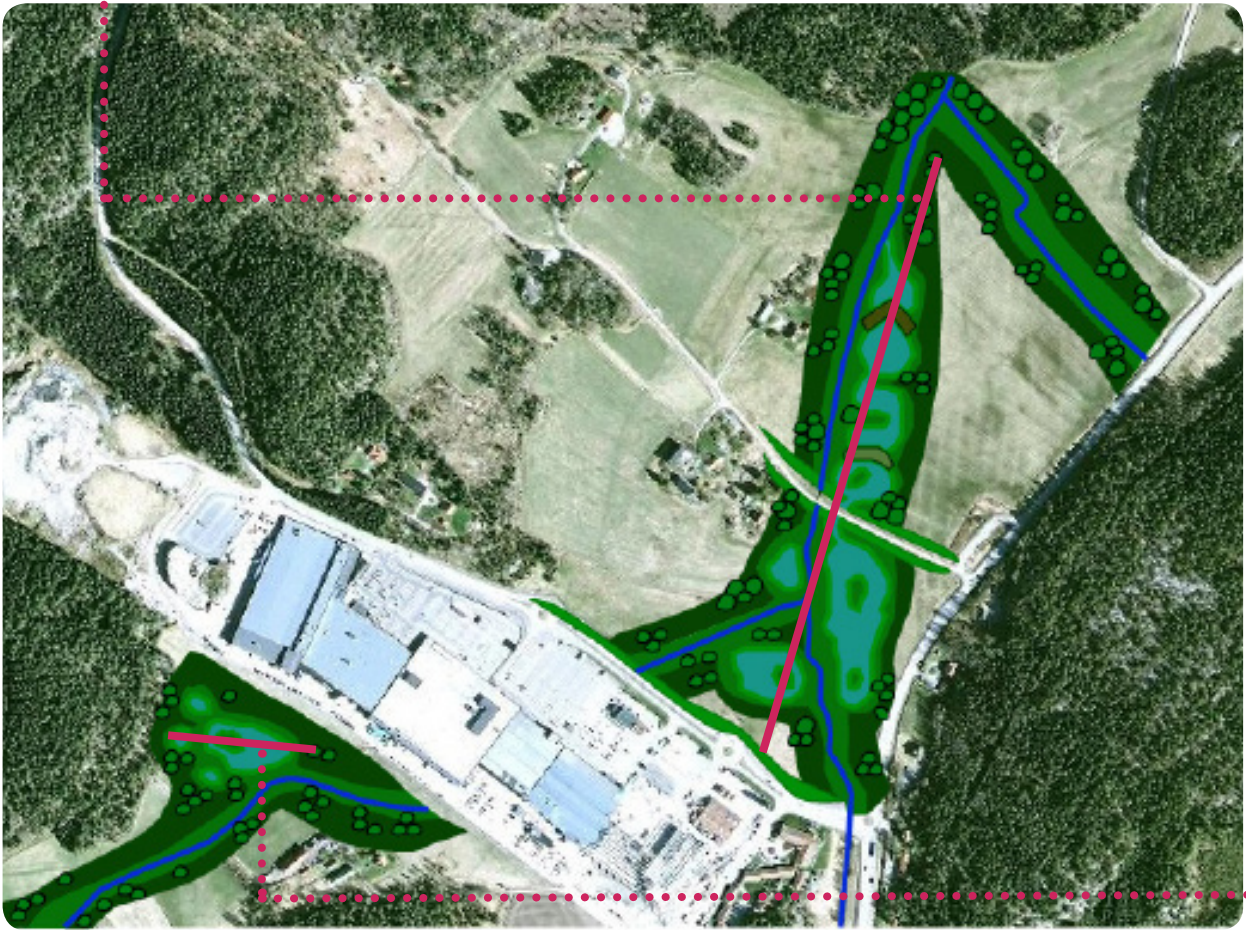


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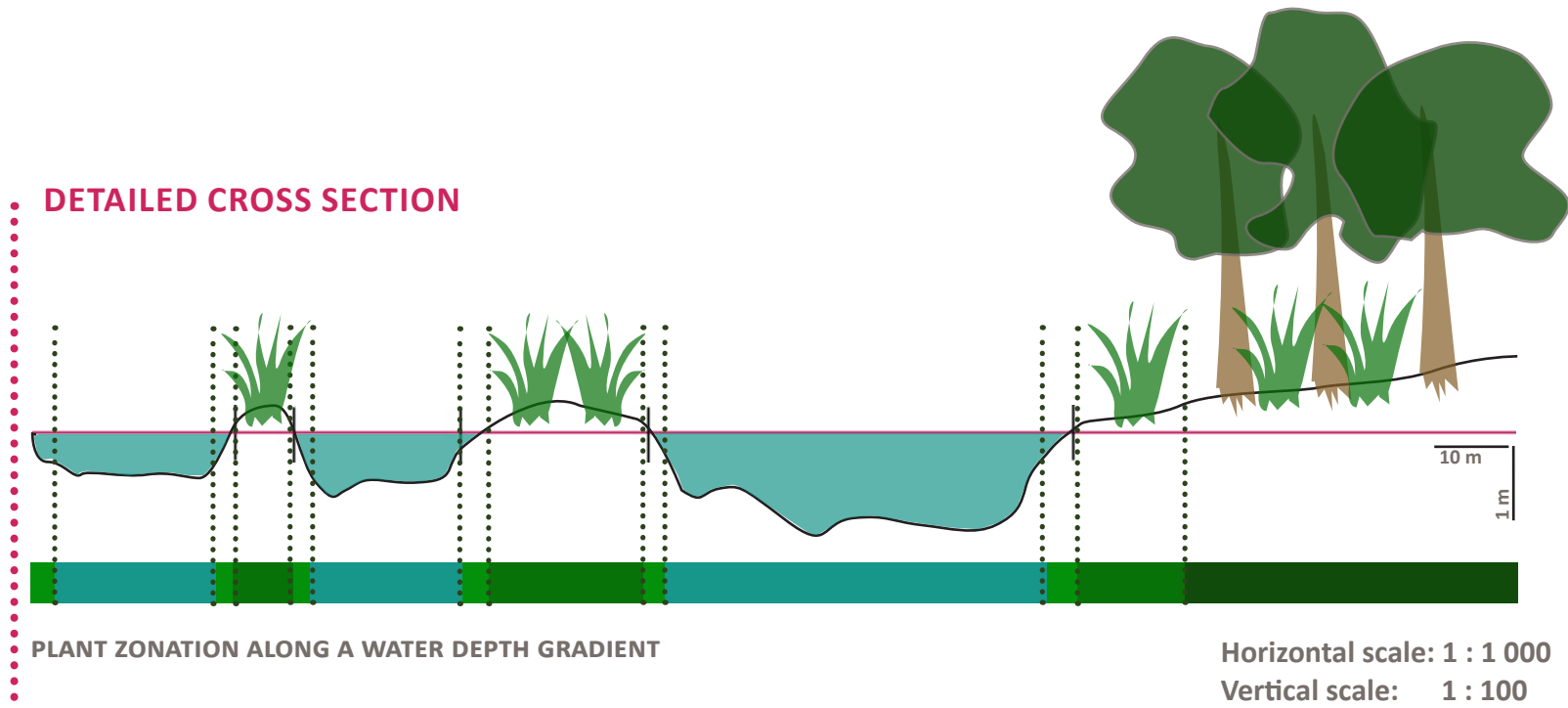
WETLAND PARK CROSS SECTIONS



GENERAL CROSS SECTION



DETAILED CROSS SECTION



VEGETATION

The vegetation corridor helps to prevent flooding, improves water quality, creates habitat for many associated species and reconnects natural patches.

Vegetation is mainly composed by emergent macrophytes which contribute to substrate oxygenation and nutrient removal by absorption/extraction and to the development of the bacterian biofilm. Wetland vegetation is adapted to temporary or permanent flooding periods.

Plant distribution around ponds and riverbanks has been determined within four zones depending on the distance to the water body.

WETLAND TREE SPECIES

Clusters of trees are also included in the design providing habitat, acting like physical barrier against flooding damage and offering higher aesthetic value. Trees deep-roots provide better soil conditions that allow better drainage, as well as absorption of nutrients and pollutants, as it is the case in species used for phytoremediation.



Alder (*Alnus glutinosa*)

- Strong roots anchorage that allows it to withstand flooding.
- Root nodules in which atmospheric nitrogen is fixed.
- Used in phytoremediation projects.



Bird cherry (*Prunus padus*)

- Low height
- Aesthetic.



Crack willow (*Salix fragilis*)

- Used in projects for phytoremediation.



Birch (*Betula pubescens*)

- Pioneer specie.
- Withstand polluted soils.
- Aesthetic.



White willow (*Salix alba*)

- Used in projects for phytoremediation.



SHALLOW POND PROFILE



DEEP POND PROFILE

ZONE 4



Purple loosestrife (*Lythrum salicaria*)

- Height: 40-150 cm.
- Dark pink flower.
- Used in different swales and wetland restoration projects.



Yellow loosestrife (*Lysimachia vulgaris*)

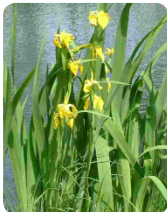
- Height: 40-150 cm.
- Yellow flower.
- Used in different swales and wetland restoration projects.

ZONE 3



Broadleaf cattail (*Typha latifolia*)

- Height: 100-200 cm.
- Green flower.
- COD and nitrogen removal.



Yellow flag (*Iris pseudacorus*)

- Height: 80 cm.
- Yellow.
- Aesthetic function.

ZONE 2



Reed (*Phragmites australis*)

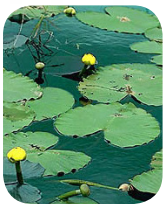
- Height: 100-200 cm.
- Green flower.
- COD and nitrogen removal.



Smooth black sedge (*Carex nigra*)

- Height: 50 cm.
- Black flower.
- Used in different swales and wetland restoration projects.

ZONE 1



Water lilies (*Nuphar lutea*)

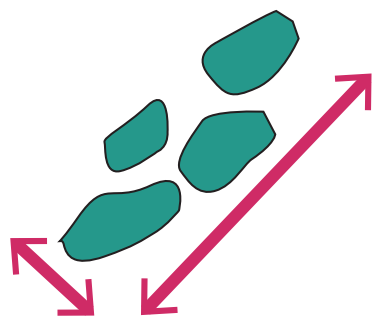
- Aquatic plant.
- At the deep ponds.
- Yellow flower.
- Oxygenates the water.



Common water-plantain (*Alisma plantago-aquatica*)

- Height: 20-100 cm.
- At the shallow ponds.
- White flower.
- COD and nitrogen removal.

ECOLOGICAL DESIGN CONSIDERATIONS

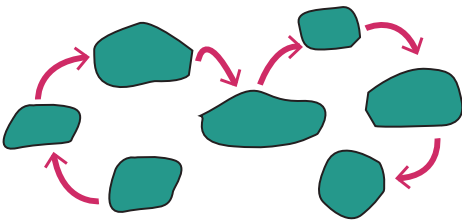


WETLAND SIZE:

A high length to width ratio is suggested to:

- Minimize **short-circuiting**.
- Maximize **water contact with biofilm substrate** for biological removing of nutrients.

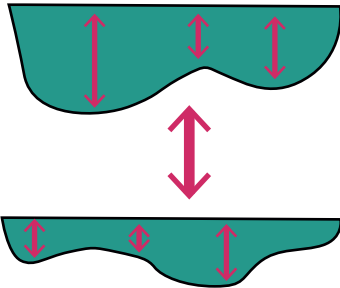
Some studies show that for the removal of nutrients, the optimum length/width ratio is 10:1 (HAMMER 1989). (Giusenne Bendoricchio, Luigi Dal Cin & Jesper Persson nd)



AMOUNT OF PONDS:

Multiple cells are suggested to:

- Enhance the performance of the system overall by decreasing the potential for **short-circuiting**. (Giusenne Bendoricchio, Luigi Dal Cin & Jesper Persson)
- Create a **mosaic of water regimes**. (Dr S.J. Moore, 1999)
- Increase **detention times**. (Department of Water, Government of Western Australia, 2007)
- Create a more diverse **range of habitats**. (Department of Water, Government of Western Australia, 2007)

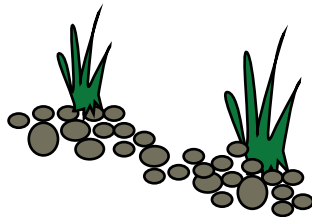


VARIETY OF DEPTHS:

Variation of depths between and within basins is needed to:

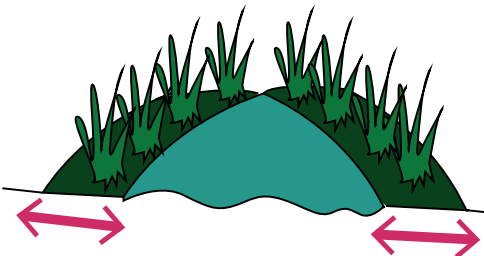
- Provide a wider **diversity of habitats** for aquatic life adapted to different hydraulic conditions.
- Promote various **chemical reactions** to transform and remove nitrogen from the system (Department of Water, Government of Western Australia, 2007)
- Provide **refuge** for fish and other aquatic organisms during fluctuating level conditions and cold weather (KNIGHT & IVERSON 1990). Deep open water also allows **pathogen kill**, increases **detention time** and provide **mixing**.

The water depth average conditions should vary within 0.1 and 0.5 m. (Giusenne Bendoricchio, Luigi Dal Cin & Jesper Persson nd)



SUBSTRATE:

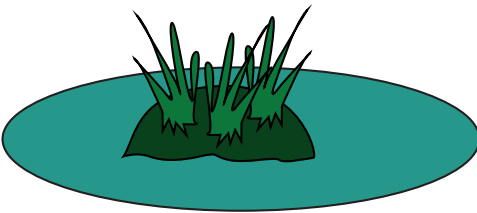
Gravel and sand of different sizes acting like **filters** and providing **support** for vegetation and bacteria biofilms.



VEGETATION BUFFER ZONE:

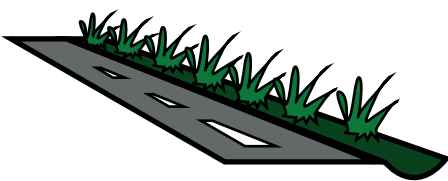
The constructed wetland and the riverbanks are protected by forested riparian buffers. They are linear multiple-row plantings of trees, shrubs and grass planted strategically to:

- Protect **water quality**, trapping and filtering sediment and pollutants
 - **Slow runoff** and may reduce downstream flooding.
 - Provide **wildlife habitat**.
- Forested riparian buffers are at least 10 meters wide but range can be up to 30 meters or wider for water quality purposes. Wider filter strips provide greater wildlife habitat benefits. (State of Minnesota nd)



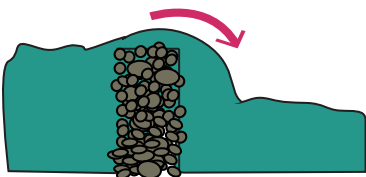
ISLANDS:

- Enhance **hydraulic efficiency** by diversion of the flow
- Provide **visual and habitat variety**.
- Wetlands birds can use the island for **nesting**, loafing and cover. In general, islands give protection to the wildlife from predators and humans. (Giusenne Bendoricchio, Luigi Dal Cin & Jesper Persson nd)



SWALES:

Wet swales as a tool to retain pollutants from the roads before they reach the water bodies.



WEIR WALLS:

Used to create a higher **diversity of habitats** and to reduce channel erosion in depth, encouraging **sedimentation**. The materials used are logs and stones. (Miliarium Aureum, S.L 2001, 2004)



PERFORMANCE IN COLD CLIMATES:

During winter months, it can be helpful to lower the water levels and allow the accumulation of snow and dead vegetation on the surface of the wetland to insulate the system. (Dr.Youbin Zheng, Siobhan Dunets and Eric Rozema nd)

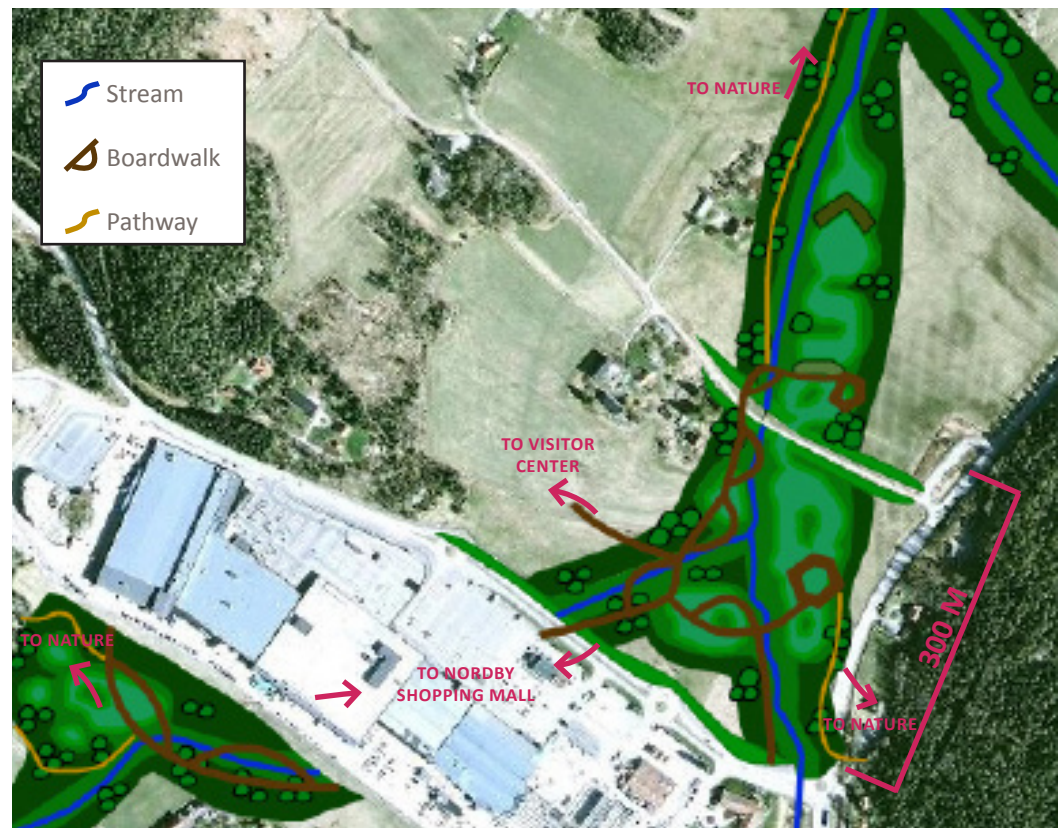


MOSQUITOES CONTROL:

Mosquito problems in wetland systems can be solved by not limiting the effectiveness of its natural aquatic predators, providing habitat to these organisms. Thick stands of surface vegetation may also limit the access of predatory fish to mosquito larvae. (Giusenne Bendoricchio, Luigi Dal Cin & Jesper Persson nd)

RECREATION AND CONNECTIVITY WITH NATURE

In order to approach people to the surrounding landscape, and to introduce them to wetland nature, it is important the creation of a path network within the wetland and out to the surrounding forests. These paths have a recreational and educational purpose, distributed in a way where natural ecosystem flows and a variety of habitats are visible.



BOARDWALK WITHIN THE WETLAND

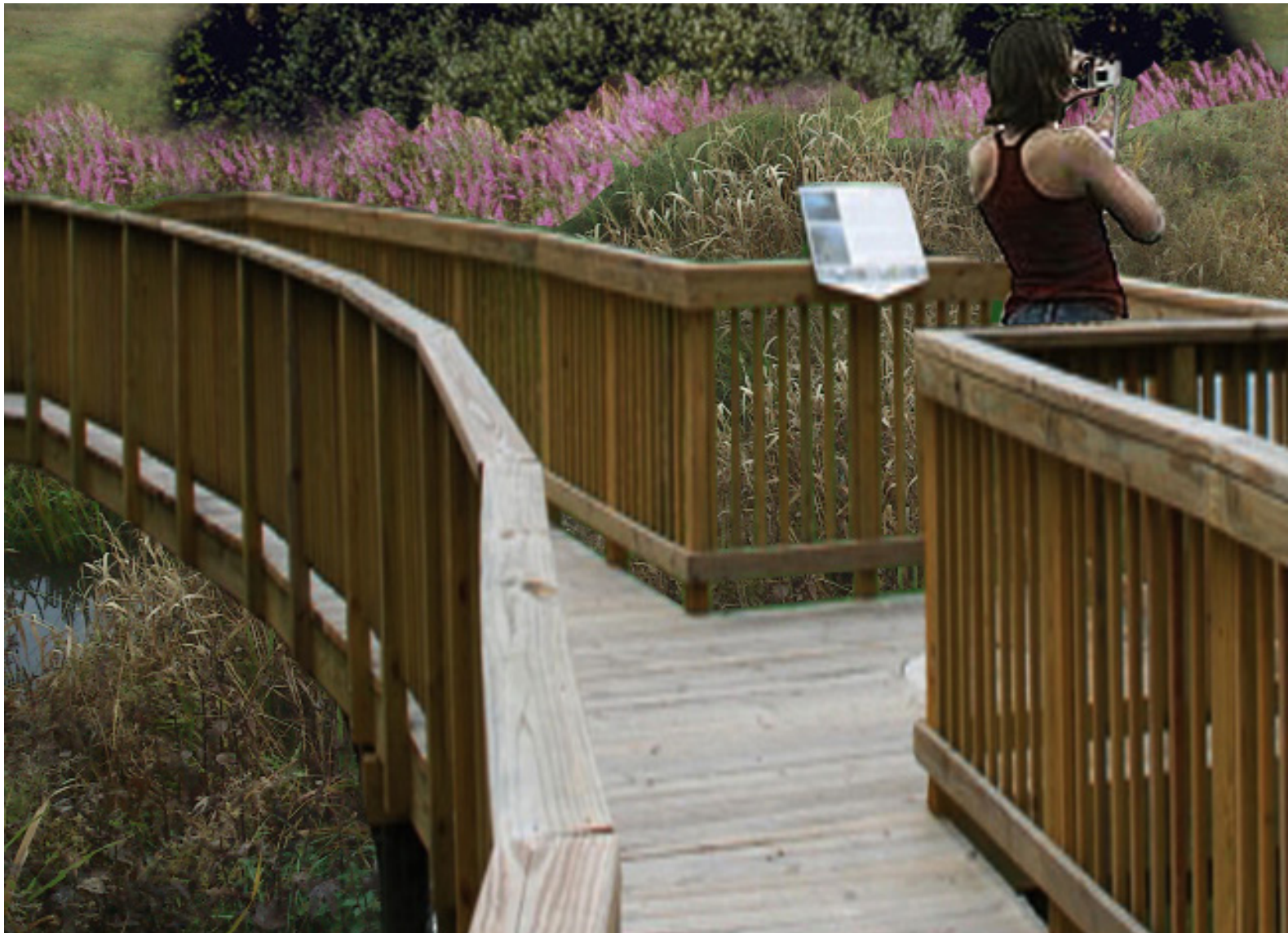
Is a constructed pedestrian walkway over the wetland and above fragile ecosystems, usually built with wood. It may include additional features such as viewing blinds or observation platforms to provide panoramic views of the wetland and facilitate bird watching or other nature watching. It is located within an area no longer than 300 m from the shopping mall in order to make it easy to pedestrians to walk around.

CONSTRUCTION OF BOARDWALKS TO REDUCE POTENTIAL FLOOD DAMAGE:

- To elevate the boardwalk enough to deal with yearly flooding and then to rebuild or repair any damage after a major flood.
- To securely bolt each section of the boardwalk to deep-seated pilings.
- To establish criss-cross railings in order to add stability to the structure against slippage.

PATHWAY OUT TO THE NATURE

From the 300 m length of the boardwalk, a pathway network is designed to allow people to wedge into the surrounding natural patches in a more visually naturalized way.



Boardwalk on the Wolf River, Tennessee
(Gary Bridgman, 2003)



Pathway

- PART 2 -

WETLAND PARK

DETAILED APPROACH

The second part of the Wetland Park proposal is divided in two sub-sections. Each sub-section deal with a different problem of those mentioned in the first part.

2.1 The first sub-section deals with the flooding problem. A detention pond, lately considered as the best solution, will be located in the rear side of the shopping mall.

2.2 The second sub-section deals with the landscape adequacy and ecological improvement of the zone, by means of a constructed wetland located in the frontal area of the shopping mall.

2.1 DETENTION POND

Detention Ponds are excavated areas designed to slow down water flow, and to hold it for a limited period of time. They are commonly used to control flooding. (Laramie County of Conservation District, 2011)

FUNCTIONAL PROCESS

The strategy of a detention pond is based on flood lamination (see Figure 1). This means that when the water flow exceeds a certain threshold, i.e the point at which flooding occurs, the amount of water above this threshold is directly diverted to the Detention Pond, preventing flooding. Water is stored in the pond and thereafter it is gradually released back into the river.

In order to accomplish its function, a Detention Pond must consist of a basin, namely the pond, dimensioned to store a certain amount of water; and both an inlet and outlet channel to connect the basin with the river and transport water from one to another.

DATA REQUIRED

Data used for the analysis of the proposal are as follows:

- **River Cross Section** (see Figure 2)
Source: Fördjupad översiktsplan Nordby-Svinesund Dagvattenutredning (WSP, 2012)
- **Maximum flow at the existing land use corresponding to different Return Periods** (see Figure 3)
Source: Fördjupad översiktsplan Nordby-Svinesund Dagvattenutredning (WSP, 2012)
- **Required Detention Pond volume**
Source: Fördjupad översiktsplan Nordby-Svinesund Dagvattenutredning (WSP, 2012)
- **Digital Elevation Model** (elevation range 0,5m)
Source: Lantmäteriet
- **Ortophoto**: an aerial photograph of the terrain.
Source: Lantmäteriet

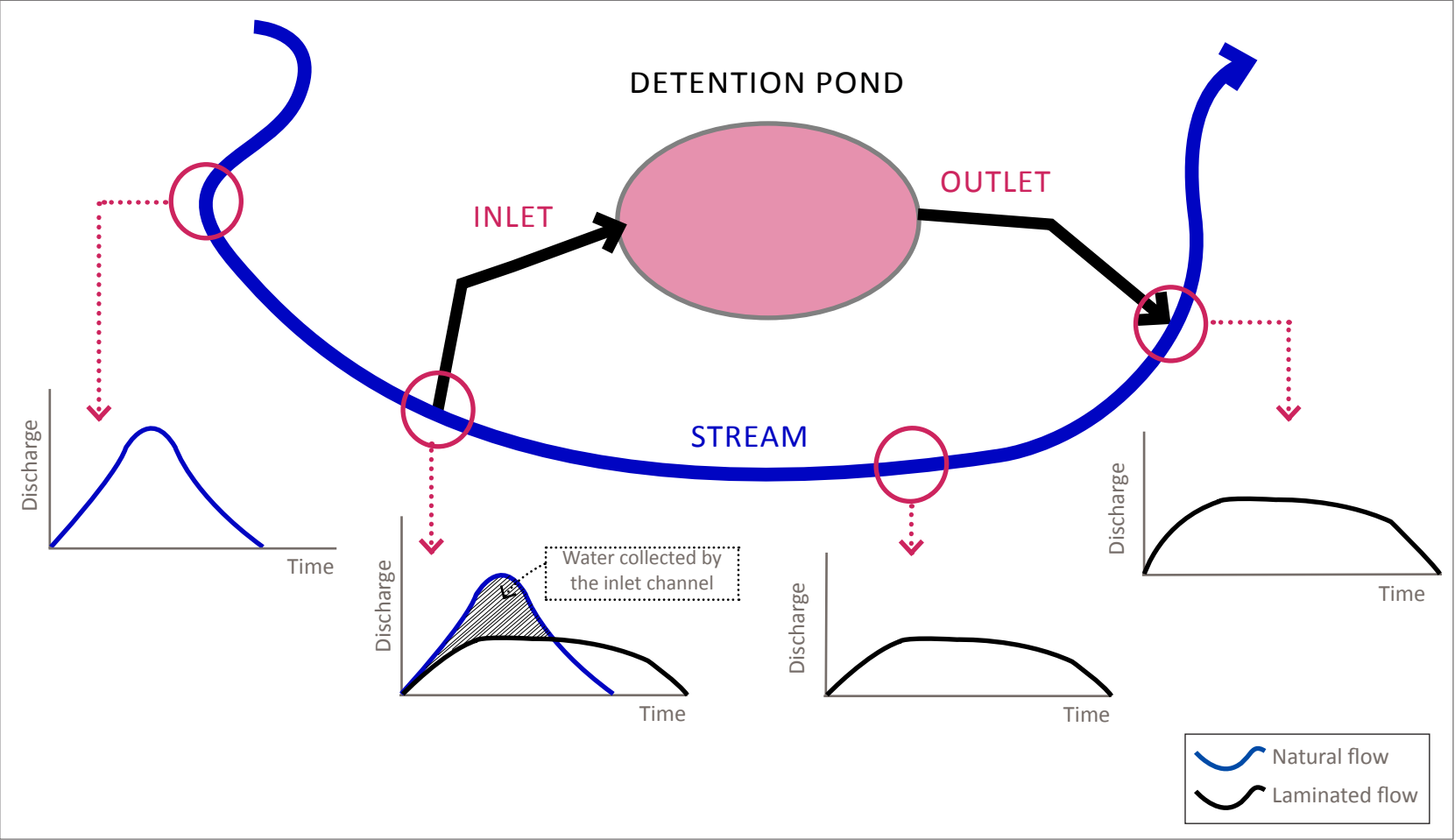


Figure 1. Flood Lamination

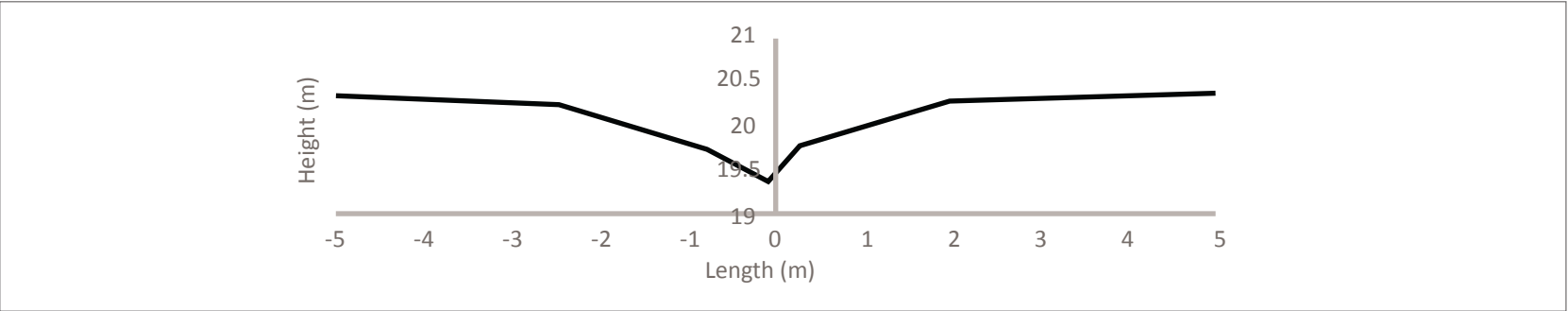


Figure 2. Cross section (WSP, 2012)

Return Period	Max. Flow
10 years	3,53 m ³
20 years	4,44 m ³
50 years	6,00 m ³
100 years	7,56 m ³

Figure 3. Maximum flow at different Return Periods (WSP, 2012)

DETENTION POND IN NORDBY

Nordby shopping mall and its surrounding land is affected by flooding. This is mainly due to the shopping mall has been built upon Kobbungsbäcken stream. It disrupts its natural variability of water discharge. In addition, the paved areas increase the effect producing a higher amount of run-off.

The solution proposed in the first part, as a general approach, was to create a wetland cell to intercept surface runoff and store stormwater. Nevertheless, after an in-depth study of the solution, it has come to realize that the most effective alternative would be a Detention Pond, being an efficient measure that allows a wider variety of uses during dry periods, and being also the solution suggested by Strömstad Municipality.

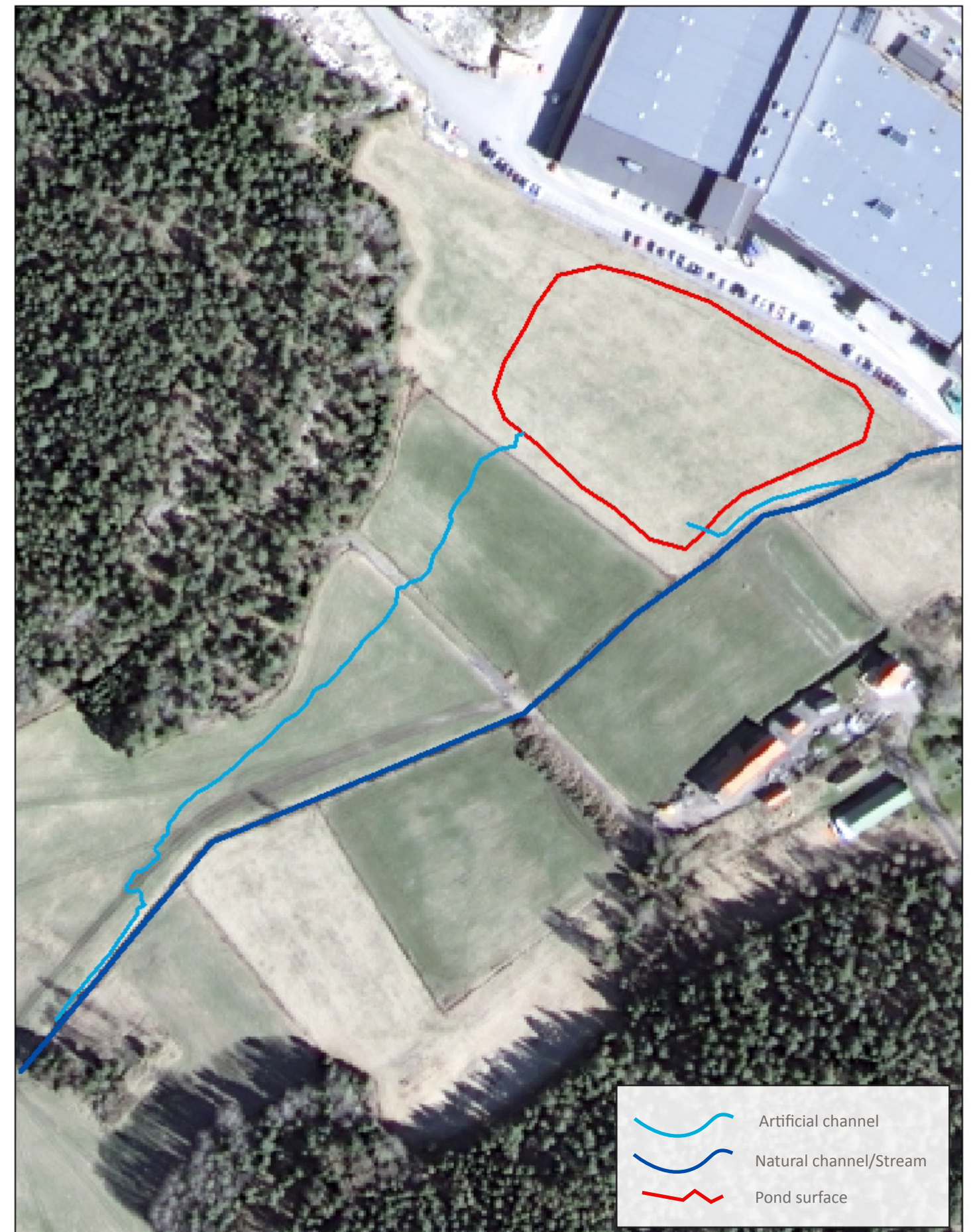
WSP, a professional services firm, redacted a document called *Fördjupad översiktsplan Nordby-Svinesund Dagvattenutredning (2012)*, namely, "In-depth master plan of stormwater investigation at Nordby-Svinesund" for Strömstad Municipality, in which the solution for flooding problems was addressed. In that document, it was established a Return Time of ten years for significant flooding problems, and it was determined the proper magazine volume needed to retain the maximum flow at this time.



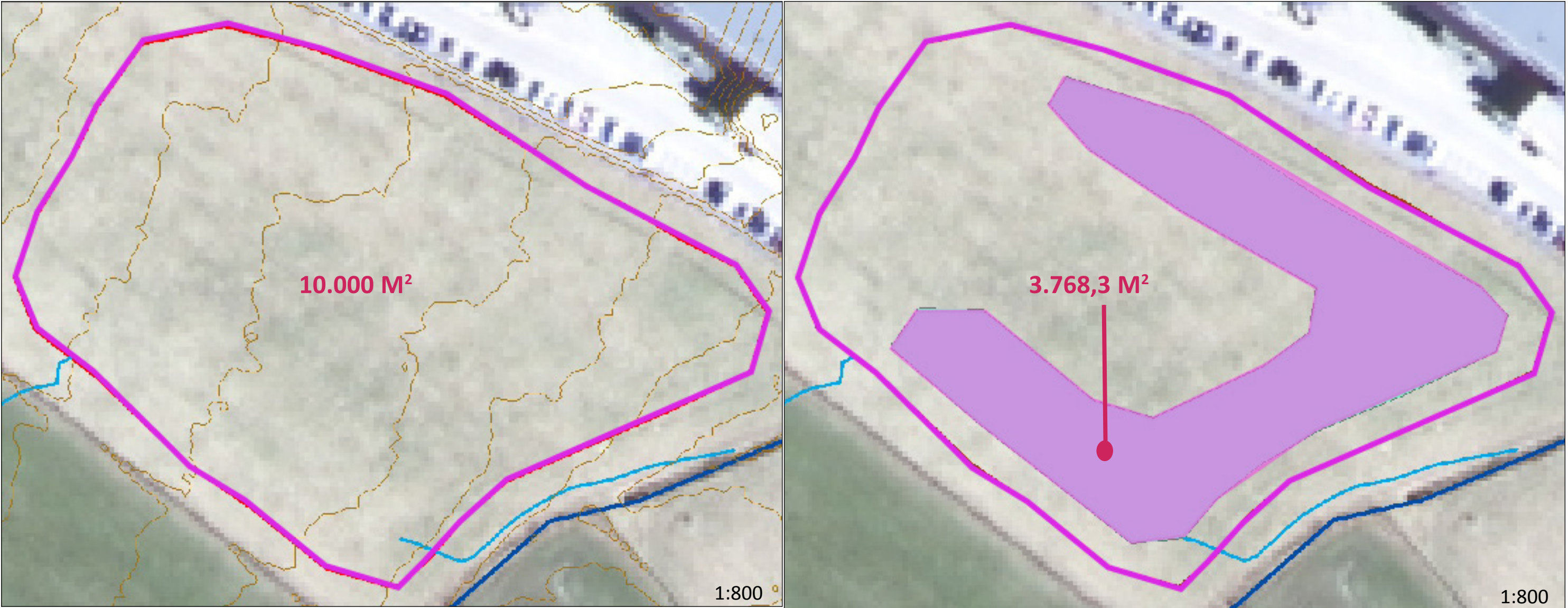
Detention pond (HydroCAD, nd)



Detention (dry) pond (inspsw, 2009)



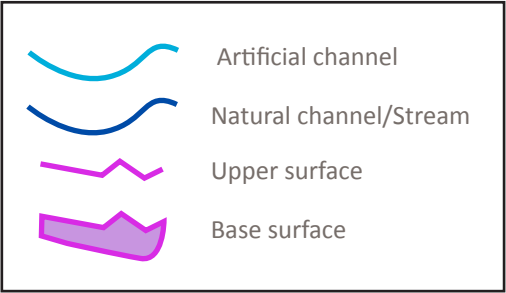
DETENTION POND OVERVIEW



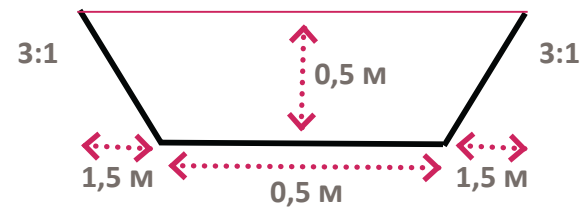
The equidistance of the contour lines is 0,5 m.

The volume of water that the Detention Pond is expected to retain accounts for **4.590 m³**.

Taking 1 ha (10.000 m²) as the upper edge surface for the pond, it has been calculated the base surface by means of the formula of the Frustum Volume, considering a depth of one meter. Being so, the area required in the bottom, in order to hold the volume of water established, is about 0,38 ha (3.768,3 m²).



INLET ARTIFICIAL CHANNEL



ARTIFICIAL CHANNEL CROSS SECTION

Taking values from the terrain and the cross section shown above. It has been calculated, through Manning Equation, the maximum discharge (m^3/s) that the artificial channel can carry.

Wetted perimeter: 3,66 m

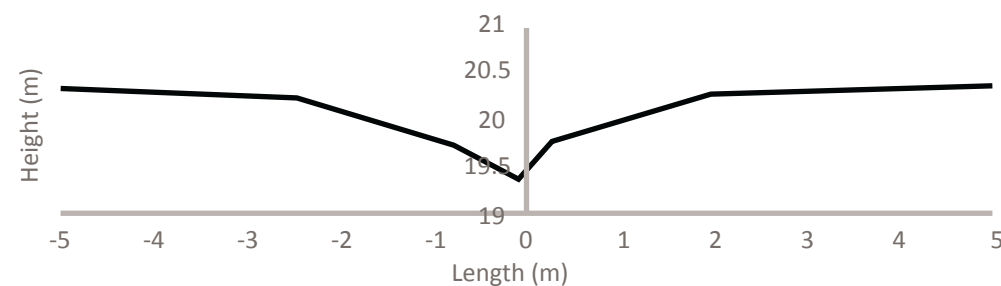
Area: 1 m^2

Hydraulic radius: 0,27 m

Slope: 0,005 m/m

Manning's roughness coefficient: 0,025

Discharge (Q)= $1,19 \text{ m}^3/\text{s}$.



NATURAL CHANNEL CROSS SECTION

Taking values from the terrain and the cross section shown above. It has been calculated, through Manning Equation, the maximum discharge (m^3/s) that the stream can withstand without flooding.

Data:

Wetted perimeter: 10,4 m

Area: $1,956 \text{ m}^2$

Hydraulic radius: 0,19 m

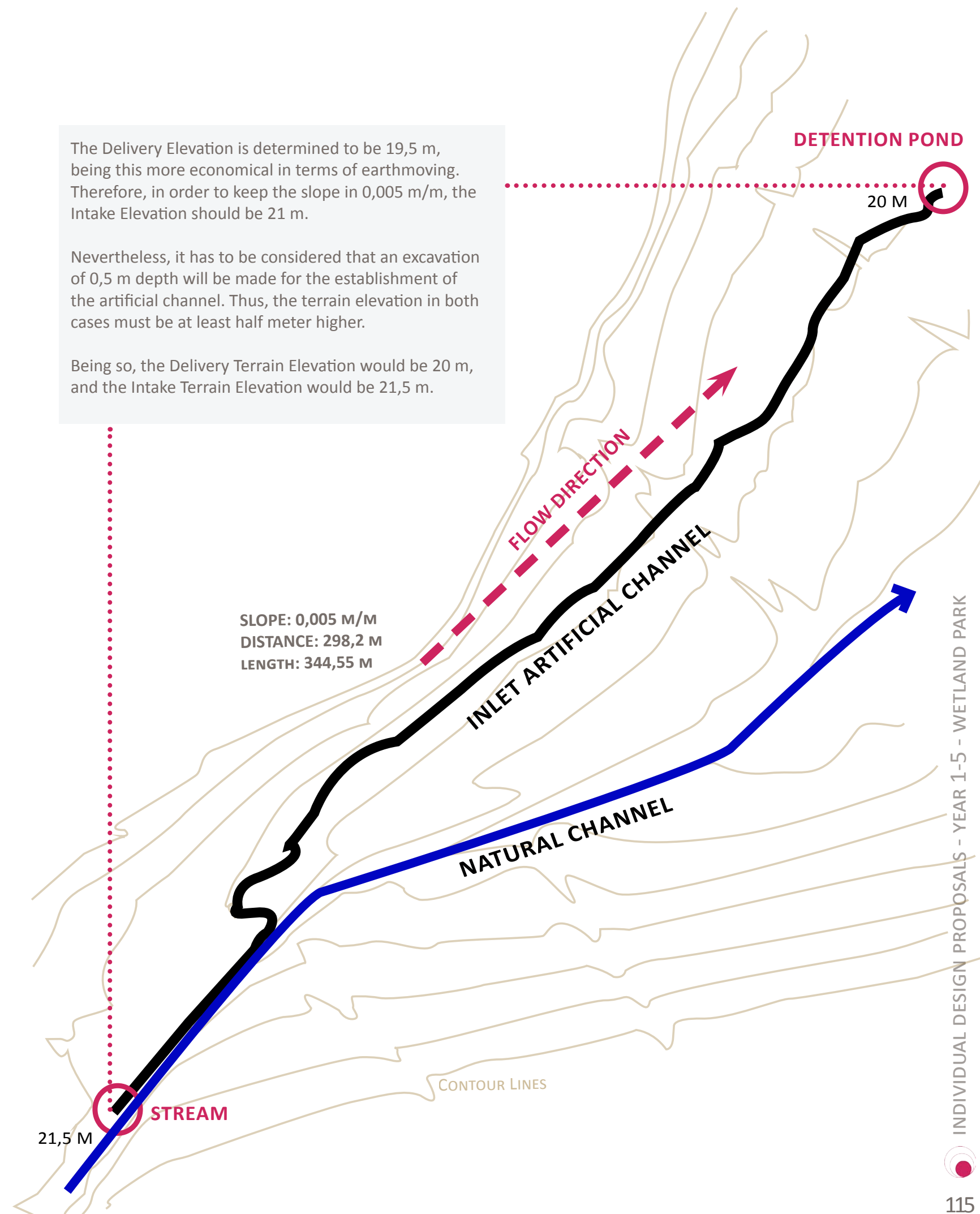
Slope: 0,0085 m/m

Manning's roughness coefficient: 0,025

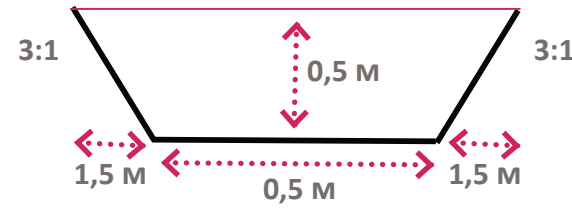
Discharge (Q)= $2,367 \text{ m}^3/\text{s}$.

It is known that the flooding problems start with a discharge corresponding to $3,53 \text{ m}^3/\text{s}$ (Return Period of 10 years). So, the water discharge needed to be carried by the artificial stream is, at least, **$1,16 \text{ m}^3/\text{s}$** .

As it has been shown before, considering the values of the artificial section, the artificial channel can carry a discharge of $1,19 \text{ m}^3/\text{s}$, so it meets the requirements.



OUTLET ARTIFICIAL CHANNEL



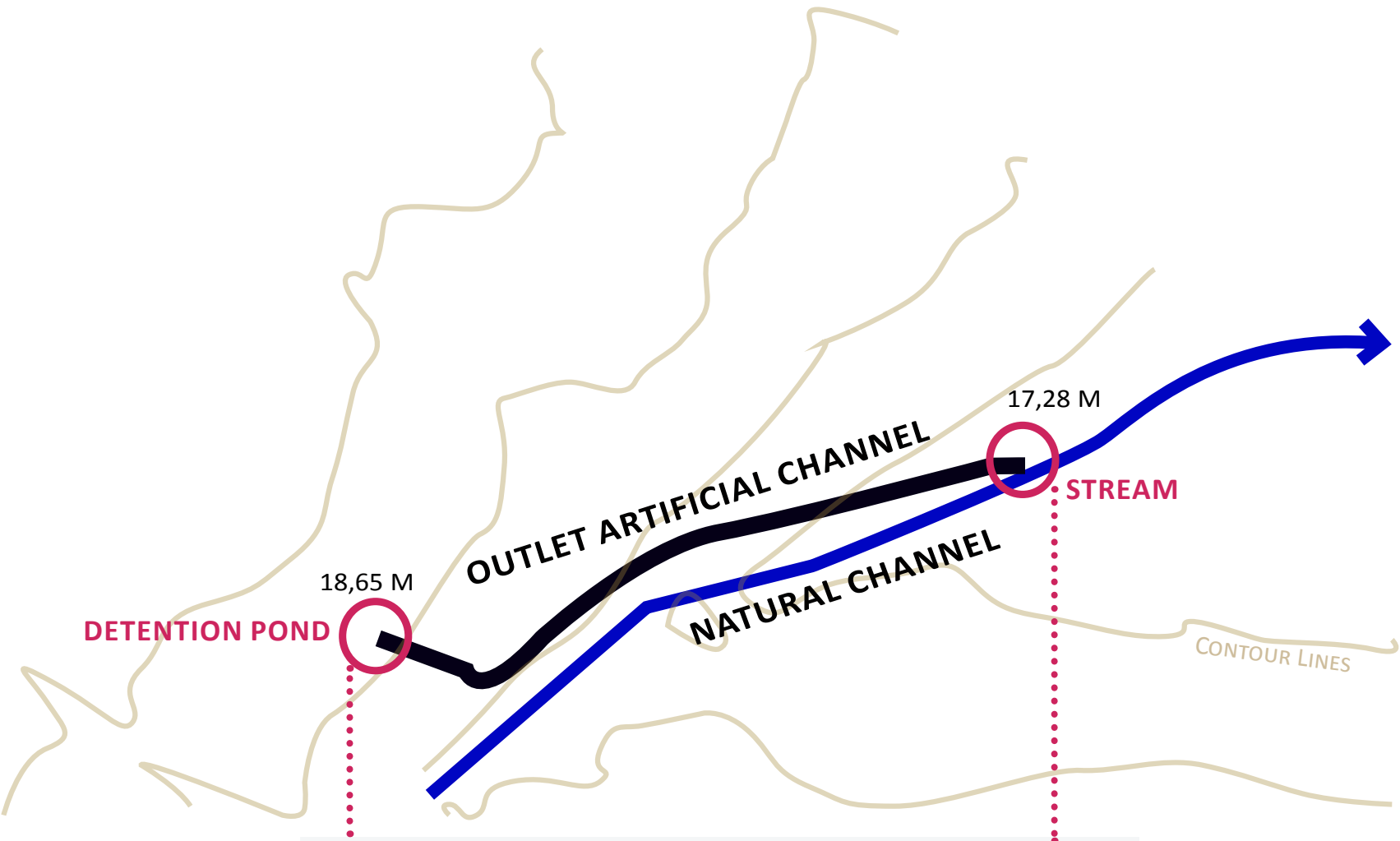
ARTIFICIAL CHANNEL CROSS SECTION

Taking values from the terrain and the cross section shown above. It has been calculated through Manning Equation the maximum discharge (m³/s) that the artificial channel can carry.

- Wetted perimeter: 3,66 m
- Area: 1 m²
- Hydraulic radius: 0,27 m
- Slope: 0,0156 m/m
- Manning's roughness coefficient: 0,025

Discharge (Q)= 2,1 m³/s.

Being greater than the minimum flow required, and therefore, valid.



In order to allow the pond to keep a certain amount of water for the uses proposed further on, a small elevation (15 cm high) would be built. Being so, the Output Elevation is determined to be 18,65 m, which corresponds to 15 cm higher than the pond base elevation (18,5 m).

The Stream Delivery Terrain Elevation would be 17,28 m, so that after excavating the artificial channel, the Stream Delivery Elevation is 16,78 m.

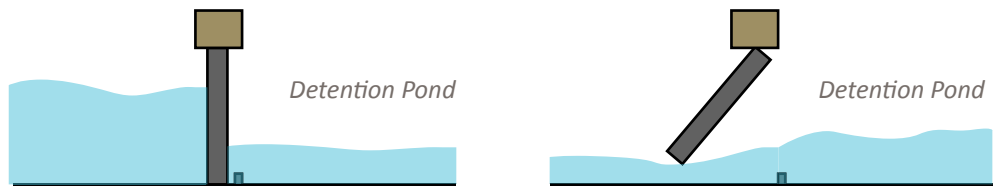
DRAINAGE SYSTEMS

FLAP GATE



Flap gate (Awma, nd)

It lets the water flow out when the water pressure in the pond is higher than that outside the pond. If this is not the case, the gate remains closed.

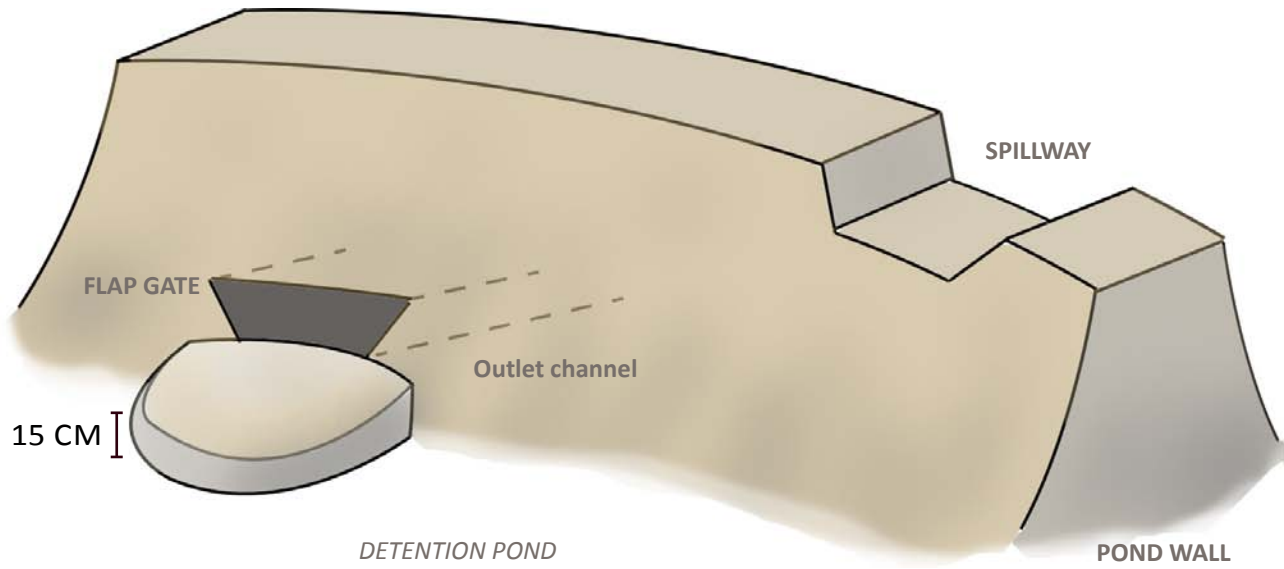


SPILLWAY

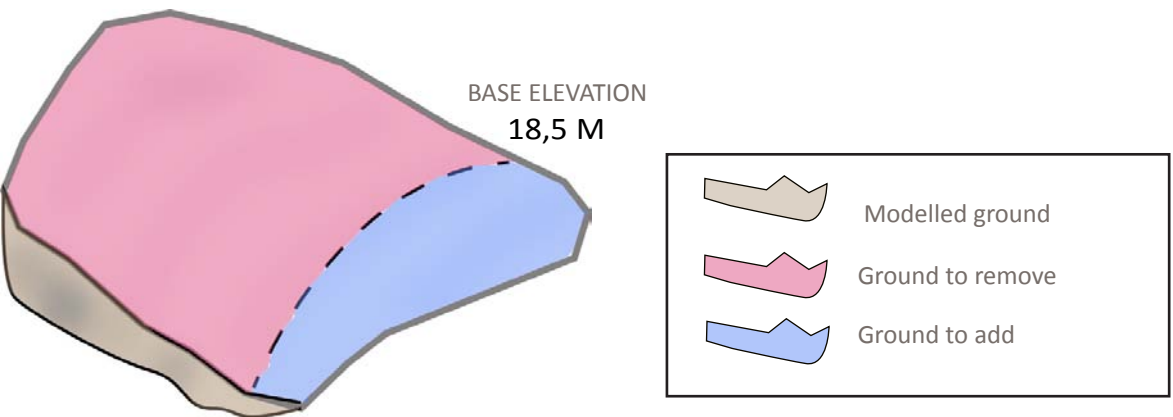


Spillway (HydroCAD, 2013)

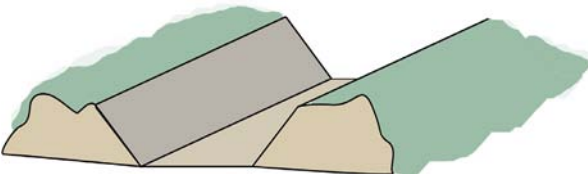
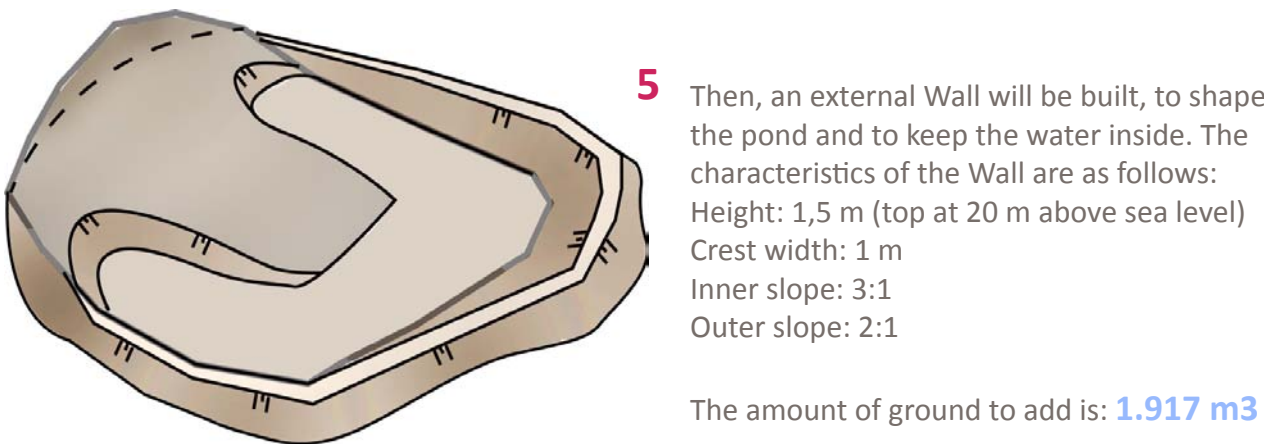
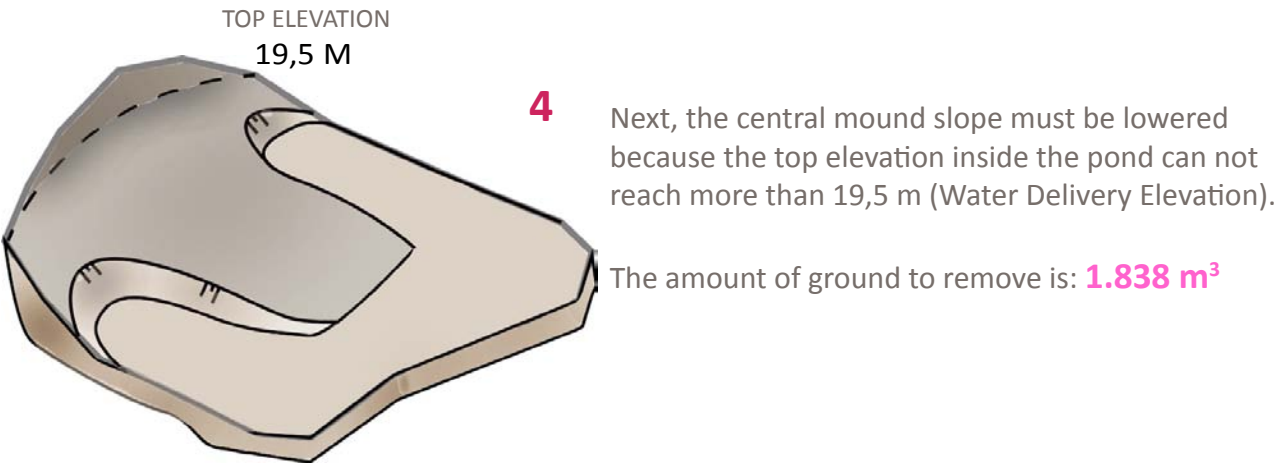
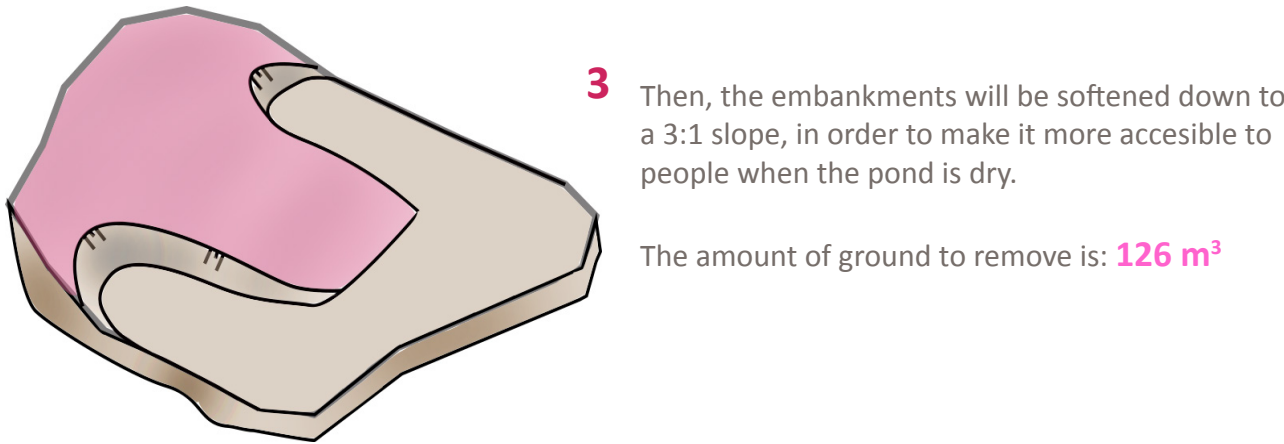
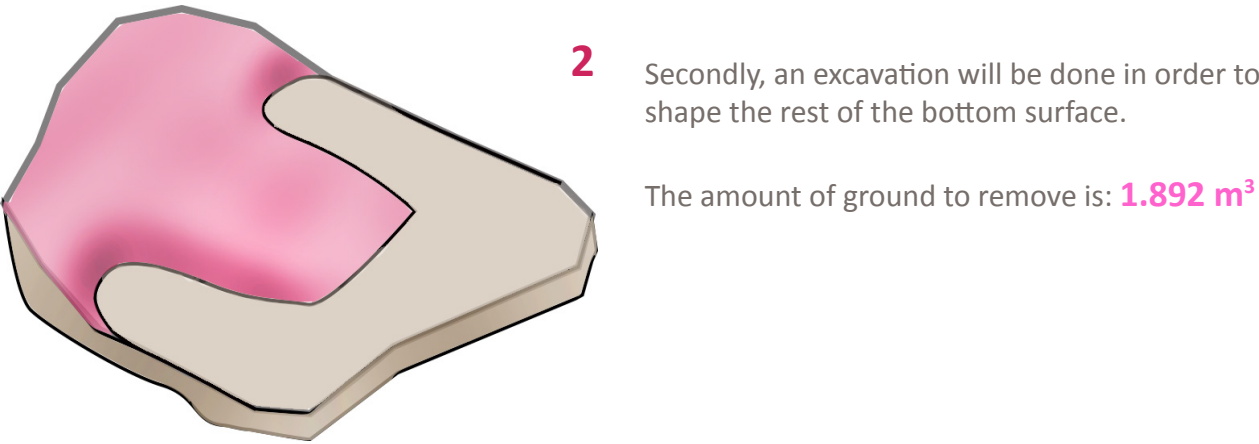
Flap gates can be easily blocked (e.g. by rocks). Therefore, a safety measure to assure a proper drainage is the establishment of a spillway at the top of the pond wall. It would have the same cross section as the artificial channel, so that it can withstand the same water flow.



EARTHMOVING



- 1** The first stage consists of filling the ground below the base elevation line (18,5 m). Doing so, part of the bottom of the pond will be leveled off.
- The amount of ground to add is: **476 m³**



Finally, it is calculated the amount of ground to be removed in order to excavate the artificial channels.

The Total amount of ground to add is: **2.393 m³**
The Total amount of ground to remove is: **4.256 m³**

The difference indicates the excess of ground that must be transported to a deposit, and it is **1.863 m³**

DETAILED POND



Nordby as a “hub” will be considered as a meeting point for the region, a place not only to buy in bulk but to relax, have leisure and experience nature.
The Detention Pond is supposed to be dry during certain months, coinciding with the winter season (November to March), also known in Scandinavia as an ice sports season.
Therefore, a proper use for this area during the drought period could be an ice track to be used by visitors.

According to the proposal of the creation of a path network mentioned in the General Approach, and in order to connect people with the valuable natural surroundings, a path would be established, crossing through the higher parts of the pond.

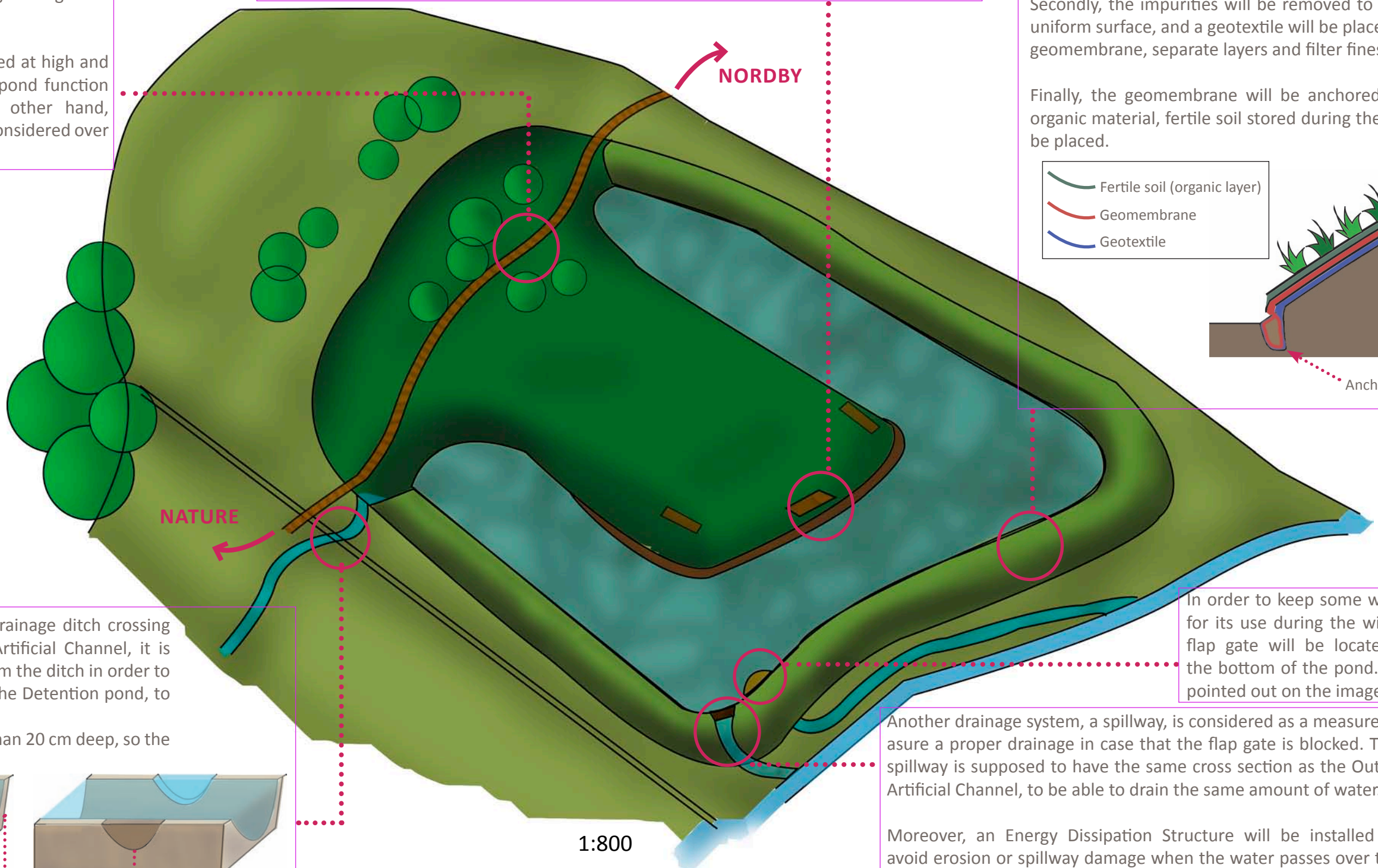
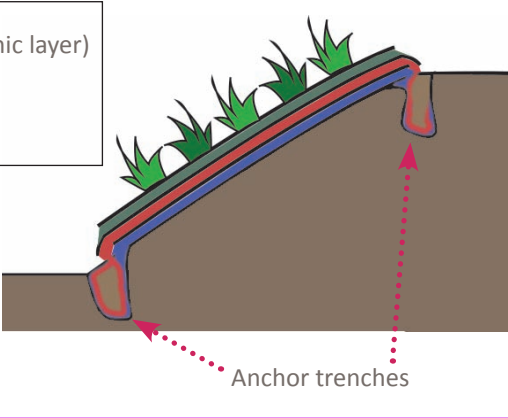
Woody vegetation will be planted at high and external areas, preventing the pond function to be compromised. On the other hand, herbaceous vegetation will be considered over the entire surface.

In order to give consistency, stability to water and to seal the wall of the Detention Pond, a **flexible waterproof geomembrane** will be established on the inner side of the wall.

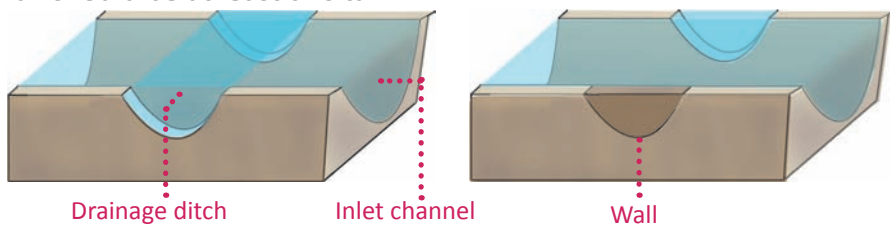
First, to reach the proper conditions to establish the geomembrane, the soil will be compacted.

Secondly, the impurities will be removed to leave a smooth, uniform surface, and a geotextile will be placed to protect the geomembrane, separate layers and filter fines.

Finally, the geomembrane will be anchored and a layer of organic material, fertile soil stored during the excavation, will be placed.



Due to a narrow and shallow drainage ditch crossing through the way of the Inlet Artificial Channel, it is needed to add a wall downstream the ditch in order to prevent the water, destined to the Detention pond, to be diverted down to the stream.
The drainage ditch is not more than 20 cm deep, so the wall should be at least this tall.



In order to keep some water in the pond for its use during the winter season, the flap gate will be located 15 cm above the bottom of the pond. This elevation is pointed out on the image beside.

Another drainage system, a spillway, is considered as a measure to assure a proper drainage in case that the flap gate is blocked. This spillway is supposed to have the same cross section as the Outlet Artificial Channel, to be able to drain the same amount of water.

Moreover, an Energy Dissipation Structure will be installed to avoid erosion or spillway damage when the water passes over the spillway. After that, the water flow will be directed into the stream through an additional channel.

2.2 CONSTRUCTED WETLAND

The creation of a Constructed Wetland at the front part of the shopping mall aims to treat the recreational and ecological improvement purposes.

The objective of this sub-section is to deal with the proper landscape adequacy for the Wetland Park while improving environmental quality and biodiversity.

After further study, it has been concluded that due to the topography it is necessary to consider a greater wetland surface in order to reduce implementation costs. Moreover, large wetland surface areas have a positive effect on biodiversity (Agnieszka Duma, 2011).

WETLAND PARK FUNCTIONS

The functions of the Wetland Park are as follows:

BIODIVERSITY AND HABITAT CREATION:

Wetlands hold a great diversity of species, many of which are rare and unique. It allows the reconnection of the area with nature, connecting sporadic patches by corridors and creating proper conditions for the development of wildlife communities which have an important ecological role in the preservation of the ecosystem.

AESTHETIC AND RECREATIONAL VALUES:

The Wetland Park offers the opportunity to develop experience routes within and outside the park for recreation and nature observation. At the same time, its own structure is a valuable aesthetic element which can bring the lost sense of place to Nordby and provide educational values.

WATER QUALITY IMPROVEMENT:

Wetland ponds allow natural processes. Using bacteria and sunlight, pollutants are broken down before the water eventually flows into downstream watercourses. Vegetation buffer zone is also protector from contamination since it is filtering pollutants (Nibusinessinfo.co.ku, nd)

DATA REQUIRED

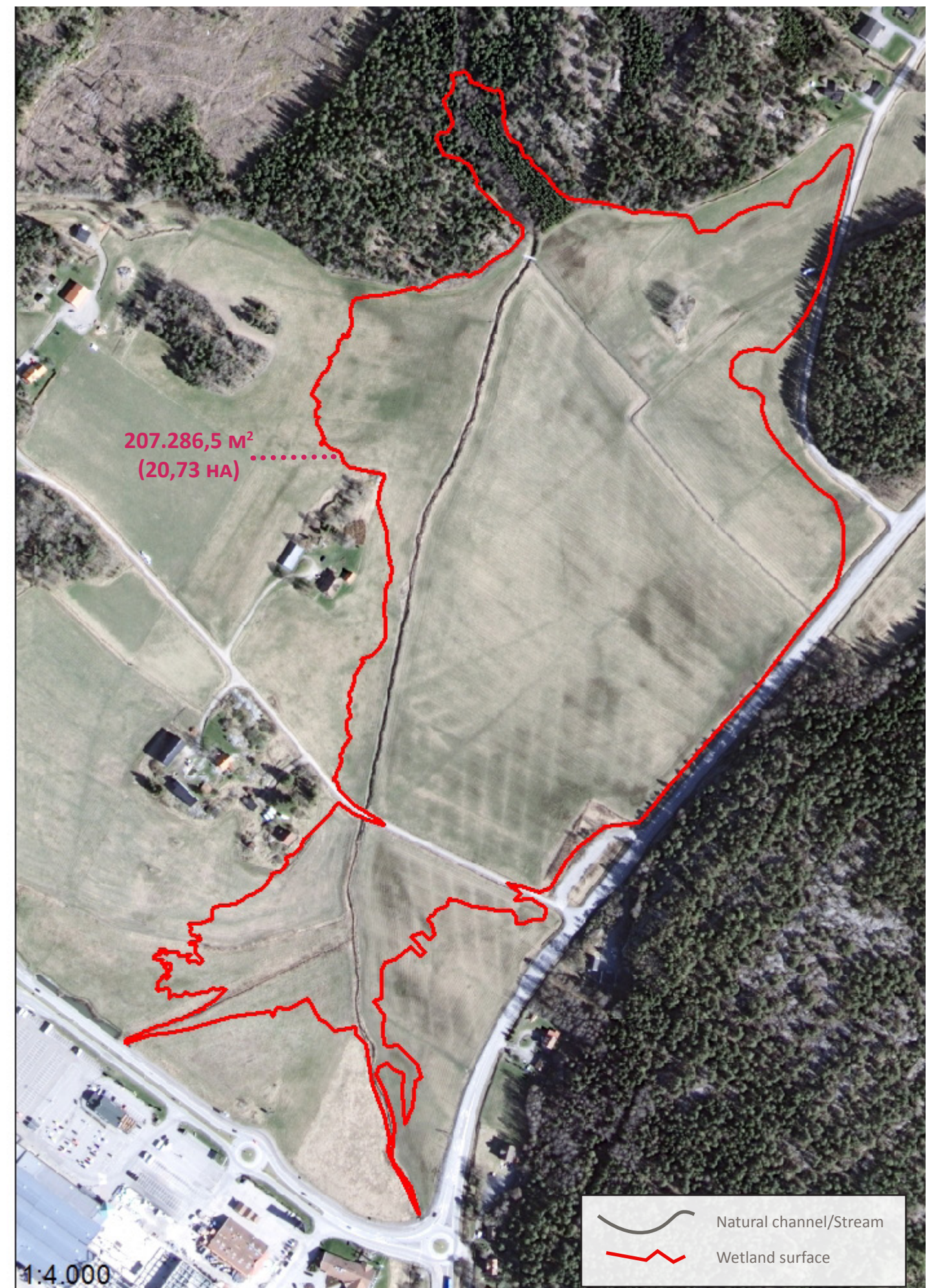
Data used for the analysis of the proposal are as follows:

- **Digital Elevation Model** (elevation range 0,5m)

Source: *Lantmäteriet*

- **Ortophoto**: an aerial photograph of the terrain.

Source: *Lantmäteriet*

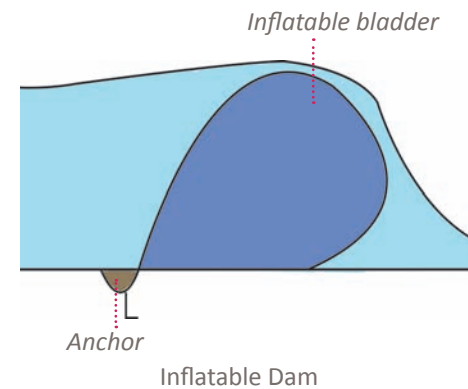


WETLAND PARK CREATION

DAM IMPLEMENTATION:

A dam will be established in order to keep the necessary amount of water for the wetland when it is needed. It is required to consider the natural seasonal fluctuation of water within the system. Being so, the dam will store water during the rainy season (September to May) and will release it during the dry season (June to August).

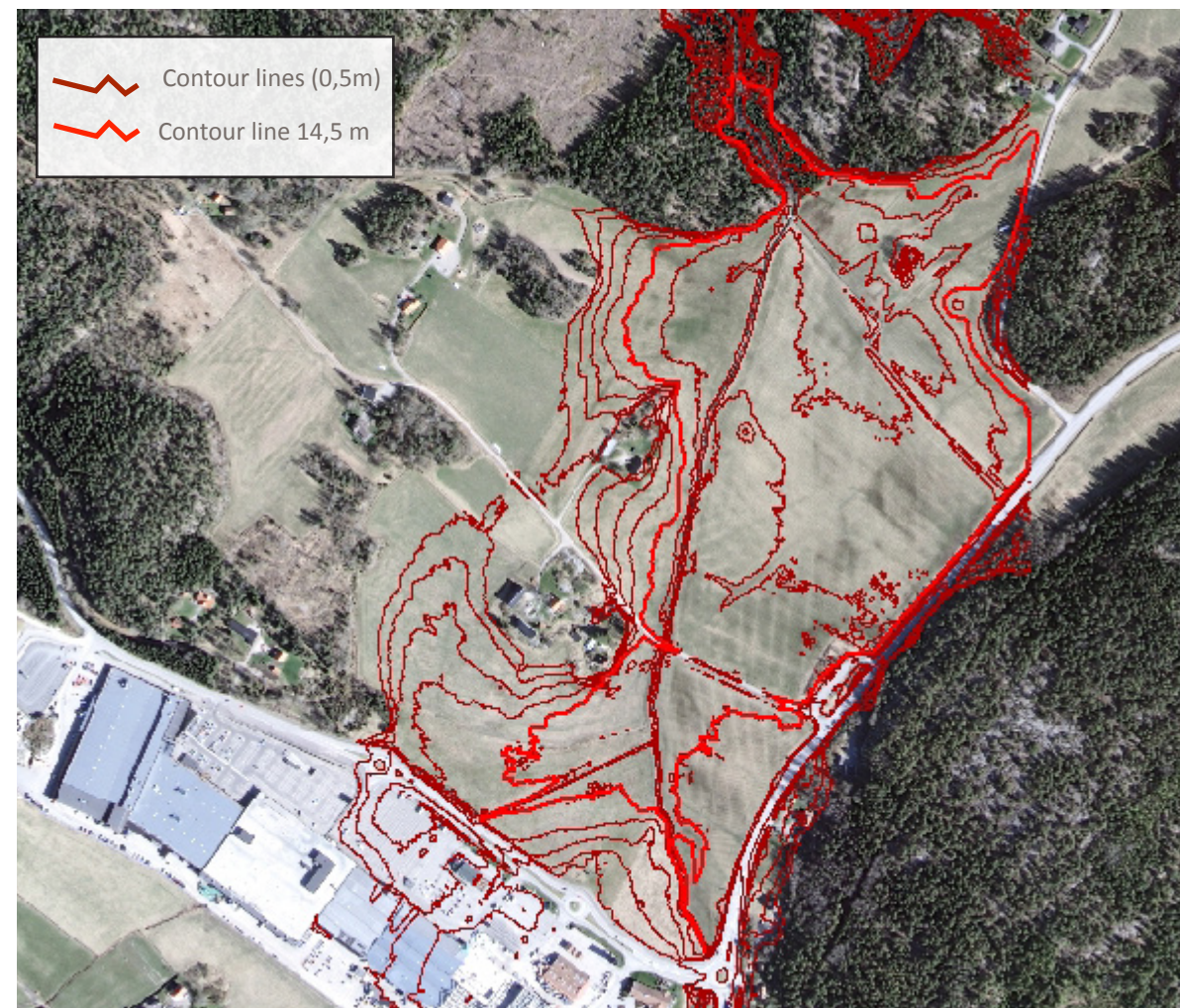
According to the terrain, the dam will be 12,3 m long and around 1 m high. The latter correspond to an elevation from 13,4 m to 14,5 m (above sea level). Therefore, after dam implementation the water surface will cover the entire area below this level (14,5 m). (See images below)



INFLATABLE DAM:

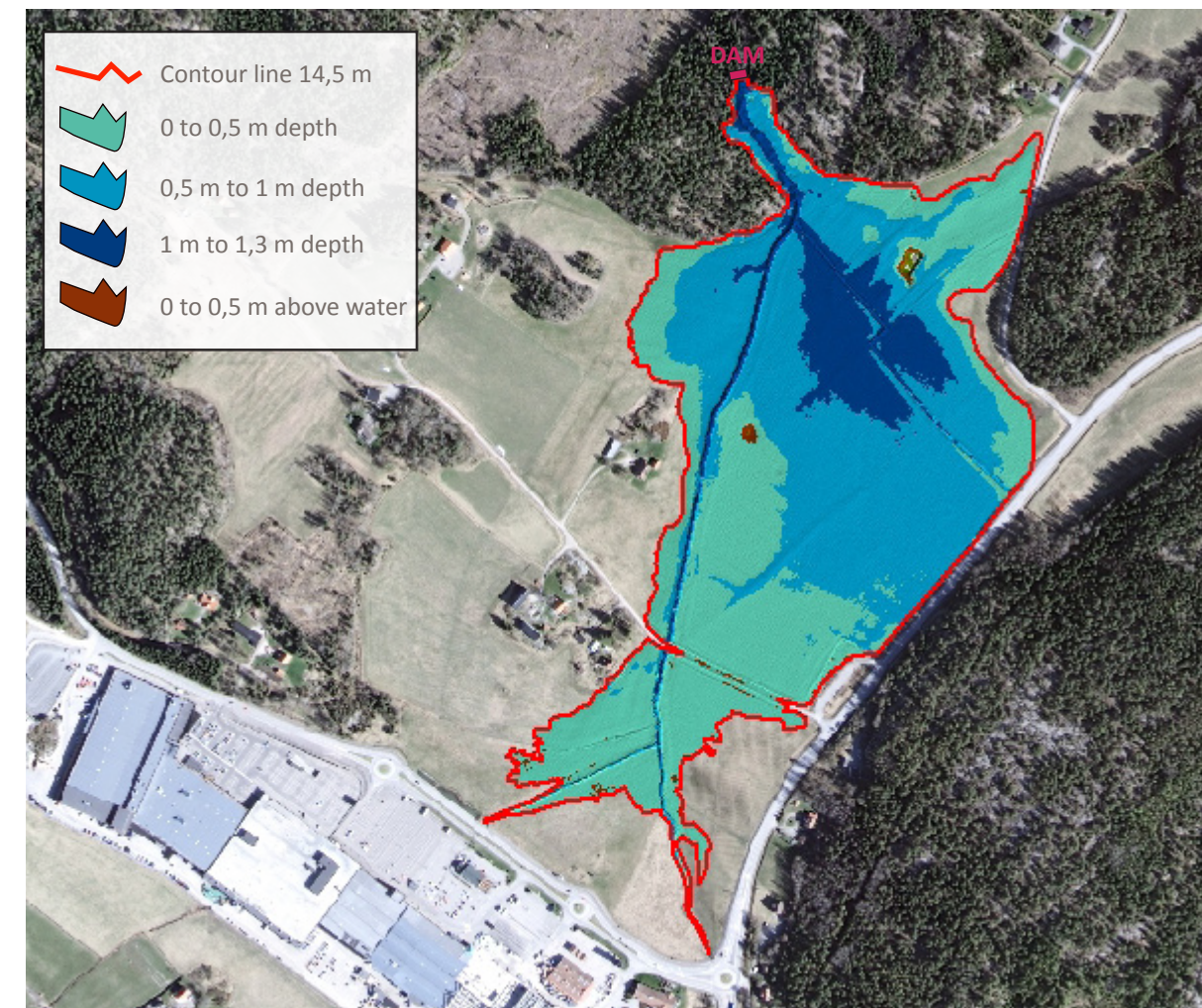
For the purpose of providing an effective alternative to maintain natural water fluctuation as well as a safe alternative to flooding, an inflatable dam could be used. They are an economical solution that can be simply and safely set up. They can be controlled by floodwater or mains from hydraulic power in case of a sudden flood. (Cloudburst, 2014).

These barrier systems can be custom built to sizes ranging from 0,3 m to 2,44 m in height and 1,83 m to 32 m in length (Nilex Inc., 2008), being in accordance with the sizes considered for this purpose (1 m high and 12,3 m long).



The map above shows the contour lines considered as necessary to understand the topography and the subsequent behavior of water after dam implementation. Elevation ranges from 13,5 m to 16,5 m (a.m.s.l). Contour lines equidistance: 0,5 m.

1:8000



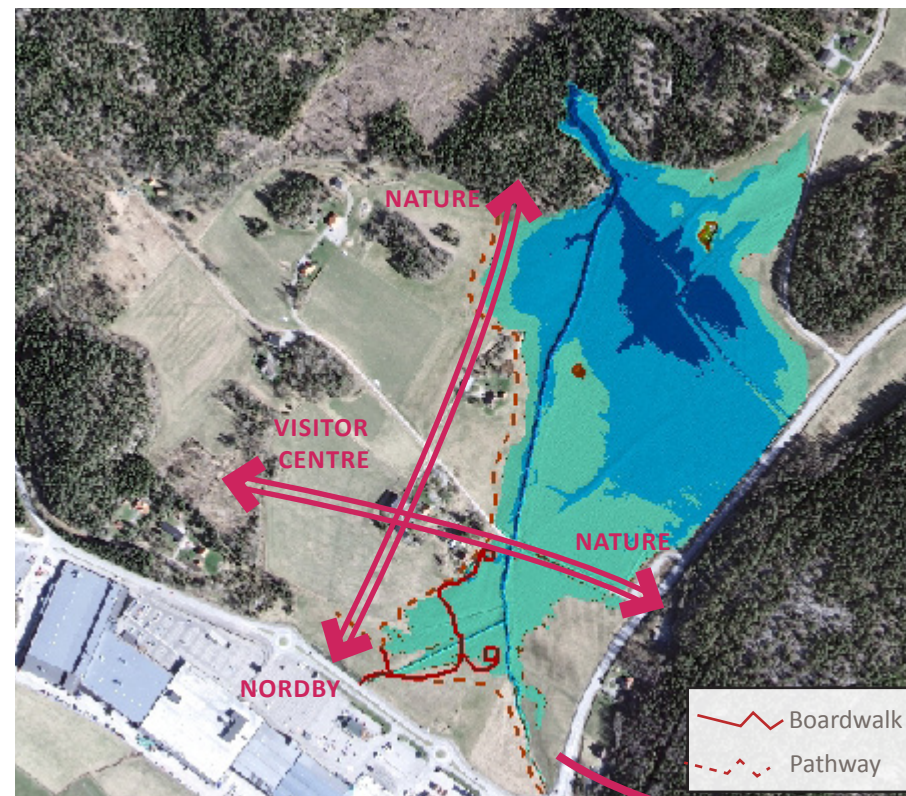
The map above shows the surface covered by the wetland after dam implementation. The water column along the wetland varies from 0 m to 1,3 m depth, creating a diversity of water regimes and possible habitats.

1:8000

WETLAND PARK DESIGN

RECREATION AND CONNECTIVITY WITH NATURE

In order to approach people to the surrounding landscape, and to introduce them to wetland nature, a path network will be created within the wetland and out to the surrounding forests. These paths have a recreational and educational purpose, distributed in a way where natural ecosystem flows and a variety of habitats are visible. Nevertheless, visitors will be concentrated in certain areas so that human pressure will not affect negatively wetland wildlife.



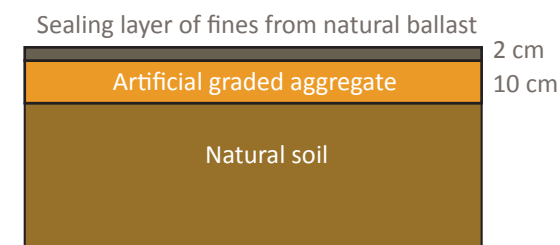
Connectivity flow map

PATHWAY

Pathways are designed to allow people to wedge into the surrounding natural patches as well as to stroll along the wetland in a more naturalized and less impacting way. Therefore, they will cover a greater distance than boardwalks.

Pathway lane width will be of 2 m, allowing the use of bicycles all along, and the distance from the wetland shore to the lane will range from 3 to 15 m. The pathway will be made up of a permeable layer of compacted artificial graded aggregate (< 10 cm), made from crushed natural gravel or quarried stone, and an upper sealing layer of fines from natural ballast (2 cm). Moreover, paths will have a drainage system to prevent water logging such as ditches. (Cepsa, nd)

Rest areas with benches will be placed along the pathway, and a viewpoint will be located in a low traffic and remote area, far enough from the shore to avoid wildlife disturbance but close enough to enable observation (around 15 m).



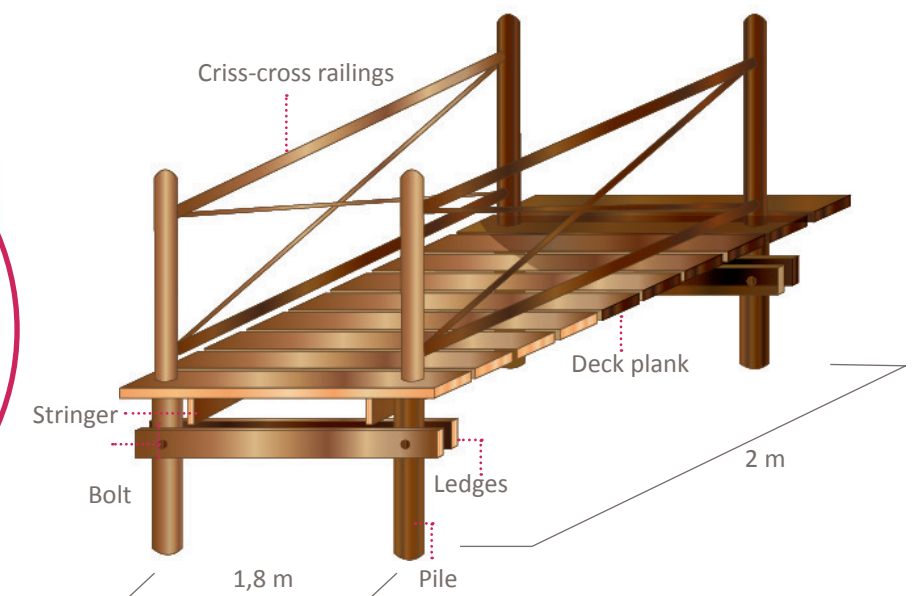
Path cross section

BOARDWALK

Boardwalks are constructed pedestrian walkways over the the wetland made of wood (e.g pine wood). They include viewing blinds and observation platforms to provide panoramic views.

An elevated boardwalk will be located within an area no longer than 300 m from the shopping mall to facilitate pedestrians to take short walks and enjoy nature. The boardwalk length will be around 550 m and some construction considerations will be undertaken:

- To elevate the boardwalk enough to deal with yearly flooding and then to rebuild or repair any damage after major flood.
- To securely bolt each section of the boardwalk to deep-seated pilings.
- To establish criss-cross railings in order to add stability to the structure against slippage.



Elevated wooden Boardwalk



Isolated viewpoint

WETLAND PARK DESIGN

ISLANDS CREATION

As mentioned in the section of Ecological Design Considerations within the General Approach (p.110), some islands will be included in the design of the Wetland Park.

The creation of islands leads to a greater habitat variety and biodiversity enhancement. Wetland wildlife may use the island for nesting, loafing, shelter and cover. Moreover, islands protect wildlife from predators and humans while providing visual diversity to the latter. (Giusenne Bendoricchio, Luigi Dal Cin & Jesper Persson, nd)

Other than that, a slope angle of 20° will be considered for the island creation in order to maintain the stability of the mound beneath the water surface. This consideration refers to the angle of internal friction of the soil which is lower underwater, being subjected the wet soil to water and wave action which threatens the stability of the island. A layer of gravel will be also established to reinforce the soil and enhance the stability of the embankment, allowing a future development of macrophytes.

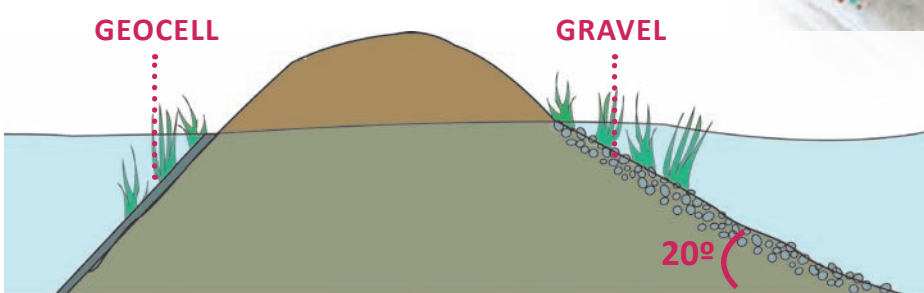
Nevertheless, a greater slope angle may also be considered. In this case, geocells should be implemented in order to provide the required ground stabilization and soil reinforcement. A geocell is a layer of interconnecting strips of geogrids or geofabrics filled with granular material, soil and gravel, to create a stiffened basal layer which can be used for our purpose (WRAP, 2010).



Geocell (EPDM sistemas, nd)



Danube gravel bank (Jan Madaras, nd)



1:3500



EARTHMOVING

Earthmoving includes the ground to add that is needed to create the islands, as well as the ground to remove in order to provide wider habitat supply and water regime diversity within the system.









- 1. Island height: 1,15 m
Island height (above water level): 0,3 m
Island surface (above water level): 560 m²
Amount of ground to add: **765 m³**
- 2. Island height: 1,4 m
Island height (above water level): 0,3-0,5 m
Island surface (above water level): 1.674,5 m²
Amount of ground to add: **2.805 m³**
- 3. Amount of ground to remove: **800 m³**
- 4. Island height: 1 m
Island height (above water level): 0,4-0,5 m
Island surface (above water level): 1.790,65 m²
Amount of ground to add: **1.960 m³**
Amount of ground to remove: **487 m³**
- 5. Amount of ground to remove: **1.800 m³**
- 6. Amount of ground to remove: **403 m³**
- 7. Island height: 0,7 m
Island height (above water level): 0,4 m
Island surface (above water level): 619,6 m²
Amount of ground to add: **483 m³**
Amount of ground to remove: **660 m³**

The total amount of ground to add: **6.013 m³**
The total amount of ground to remove: **4.150 m³**
The difference indicates the amount of ground that is still needed to create the islands, **1.863 m³**, which coincide with the amount in excess from the Detention Pond already studied.

Being so, the balance of earthmoving for the entire proposal will be zero.

WETLAND VEGETATION

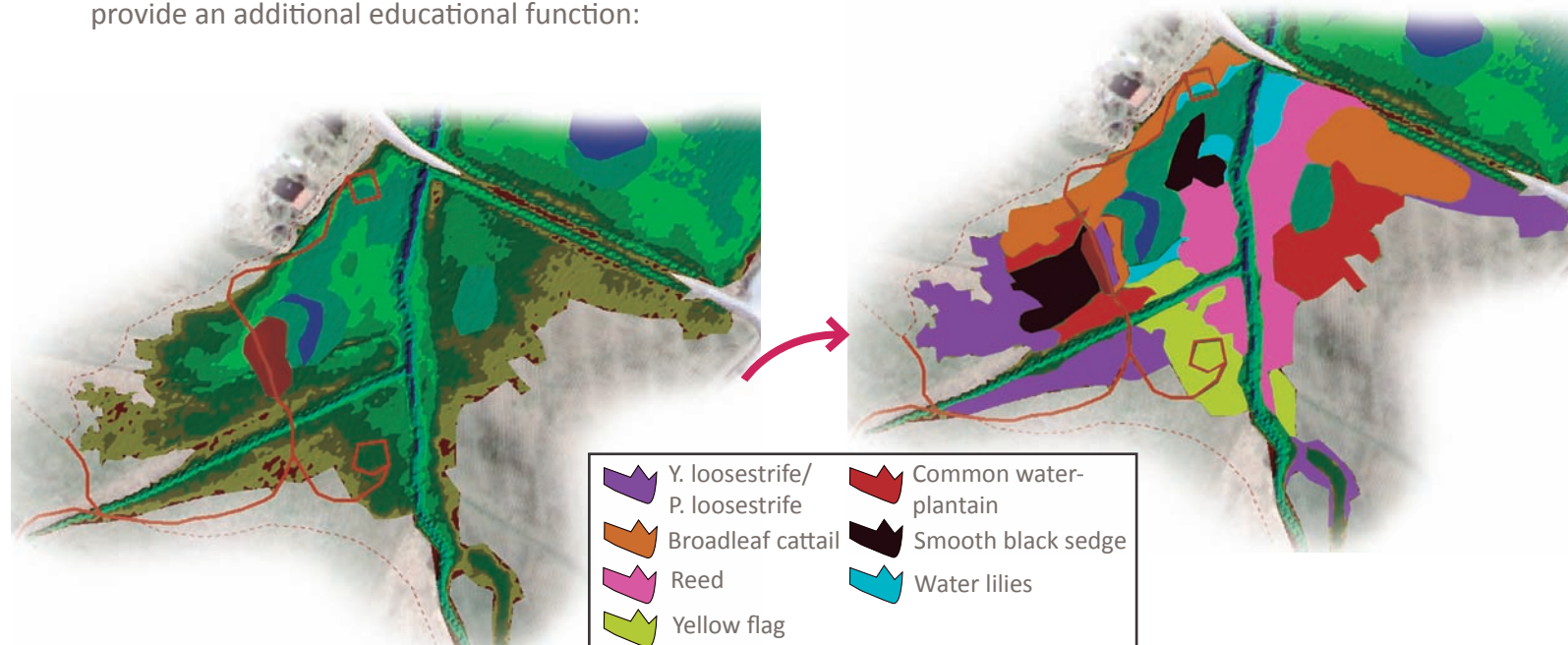
Vegetation is mainly composed by emergent macrophytes which contribute to substrate oxygenation and nutrient removal through absorption and to the development of the bacterian biofilm. Wetland vegetation is adapted to temporary or permanent flooding periods. Plant distribution around the wetland has been considered according to the depth of water required by the vegetation:

	Purple loosestrife (<i>Lythrum salicaria</i>) • Water depth: 0 - 0,1 m		Yellow loosestrife (<i>Lysimachia vulgaris</i>) • Water depth: 0- 0,06 m
	Reed (<i>Phragmites australis</i>) • Water depth: 0 - 0,4 m		Smooth black sedge (<i>Carex nigra</i>) • Water depth: 0,1 - 0,3 m
	Broadleaf cattail (<i>Typha latifolia</i>) • Water depth: 0 - 1 m		Yellow flag (<i>Iris pseudacorus</i>) • Water depth: 0- 0,2 m
	Water lilies (<i>Nuphar lutea</i>) • Water depth: 0,4 - 1 m		Common water-plantain (<i>Alisma plantago-aquatica</i>) • Water depth: 0 - 0,3 m

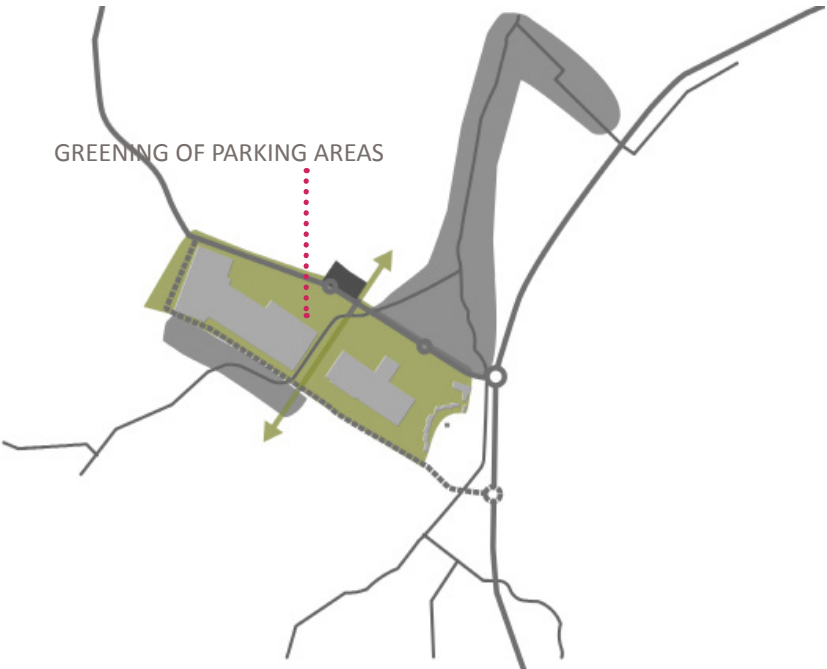
The vegetation will be distributed around the wetland depending on the areas where the water depth suits their requirements. Nevertheless, not all the suitable surface available will be occupied, concentrating plants around shores and islands up to a water depth of 0,4 m, and so leaving a wide open water surface (see map beside).

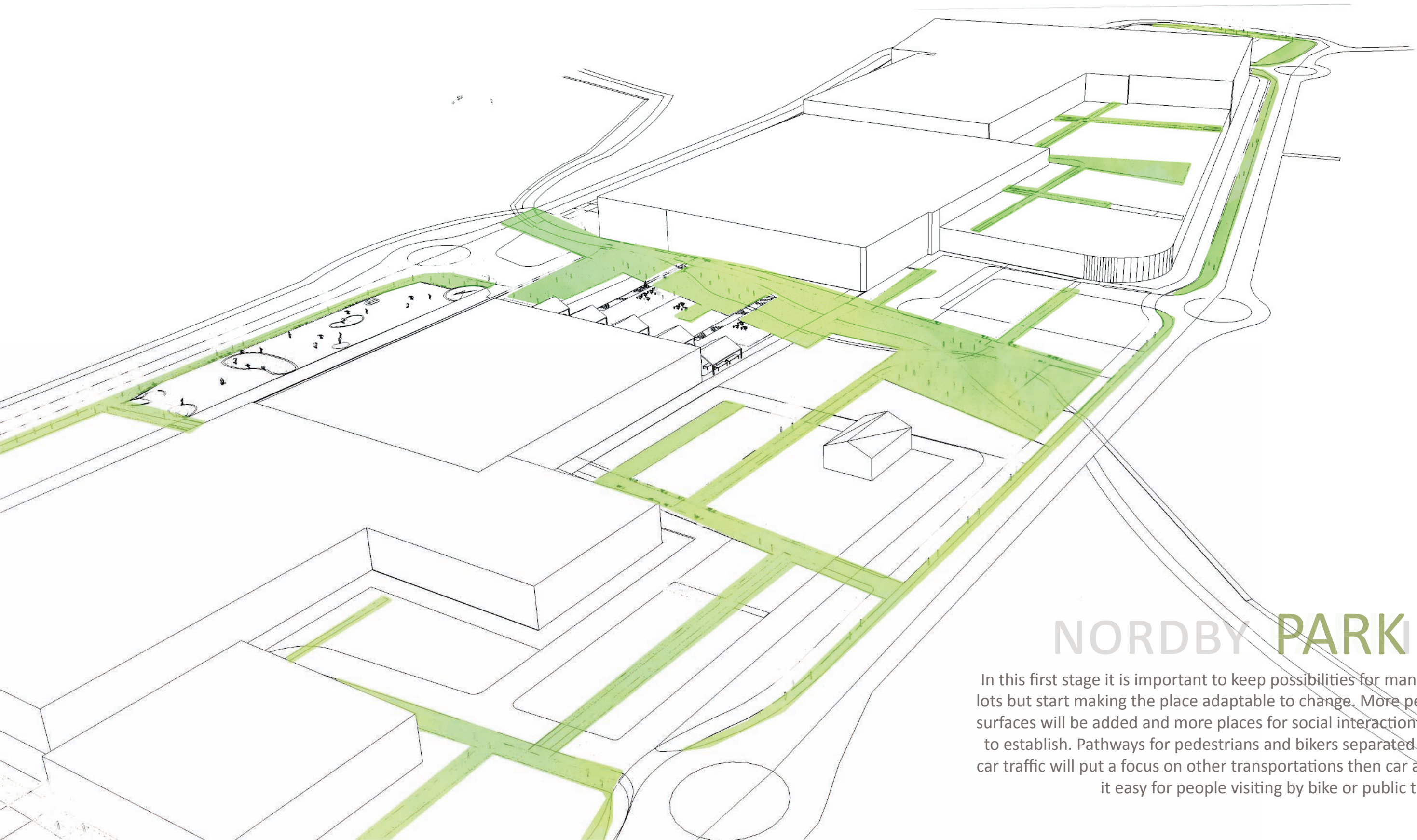
Islands surface may hold vegetation corresponding to those plants which may withstand a water depth of 0 m, namely, purple loosestrife, yellow loosestrife, reed, broadleaf cattail, yellow flag and common water-plantain. Trees considered (see General Approach: Vegetation, p.109) will be planted in groups along the wetland shore. Furthermore, it will be taken into account that the vision is not obstructed from the viewpoint and recreational sites.

The vegetation of the recreational area, focused in the southwest of the Wetland Park, will be distributed in specific groups in order to provide an additional educational function:



NORDBY PARKING
MALIN WINBLAD
FIRST STAGE
YEAR 1-5

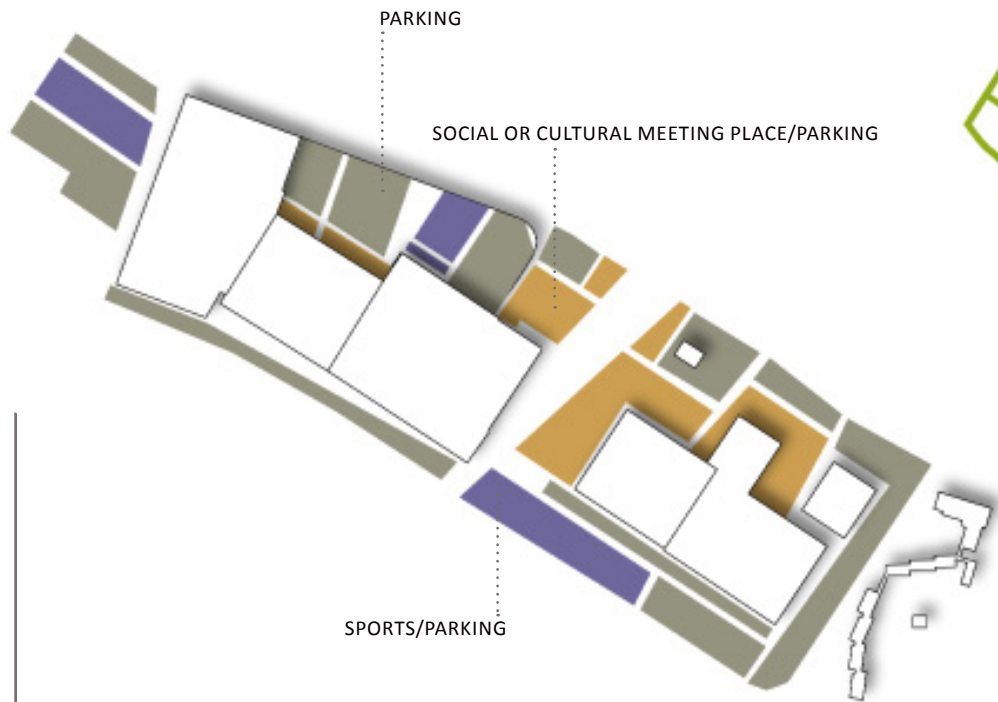




NORDBY PARKING

In this first stage it is important to keep possibilities for many parking lots but start making the place adaptable to change. More permeable surfaces will be added and more places for social interaction will start to establish. Pathways for pedestrians and bikers separated from the car traffic will put a focus on other transportations then car and make it easy for people visiting by bike or public transport.

MAIN IDEAS



CHANGEABLE AREAS



THE STRUCTURE OF THE DESIGN PROPOSAL IS INSPIRED BY THE AGRICULTURAL PATCHES THAT IS SURROUNDING THE MALL. THE PATCHES IS DEFINED BY ITS OPENNESS AND THEY ARE DIVIDED BY GREEN WEDGES.



THE DIFFERENT PATCHES SERVE DIFFERENT FUNCTIONS WHERE BOTH SOCIAL MEETING PLACES AND PARKING LOTS IS INCLUDED.



THE LARGE OPEN AREAS MAKES IT POSSIBLE FOR CHANGES DEPENDING ON THE OCCASION, PARKING AREAS COULD TURN TO A SCENE, A MARKET OR A SPORTS PLACE.



CONTINUOUS GREEN STRUCTURE



A GREEN WEDGE PARK THROUGH THE MALL CONNECTS THE HABITATS ON EACH SIDE AND LETS KOBUNGSBÄCKEN HAVE A MORE NATURAL FLOW THROUGH THE ARE



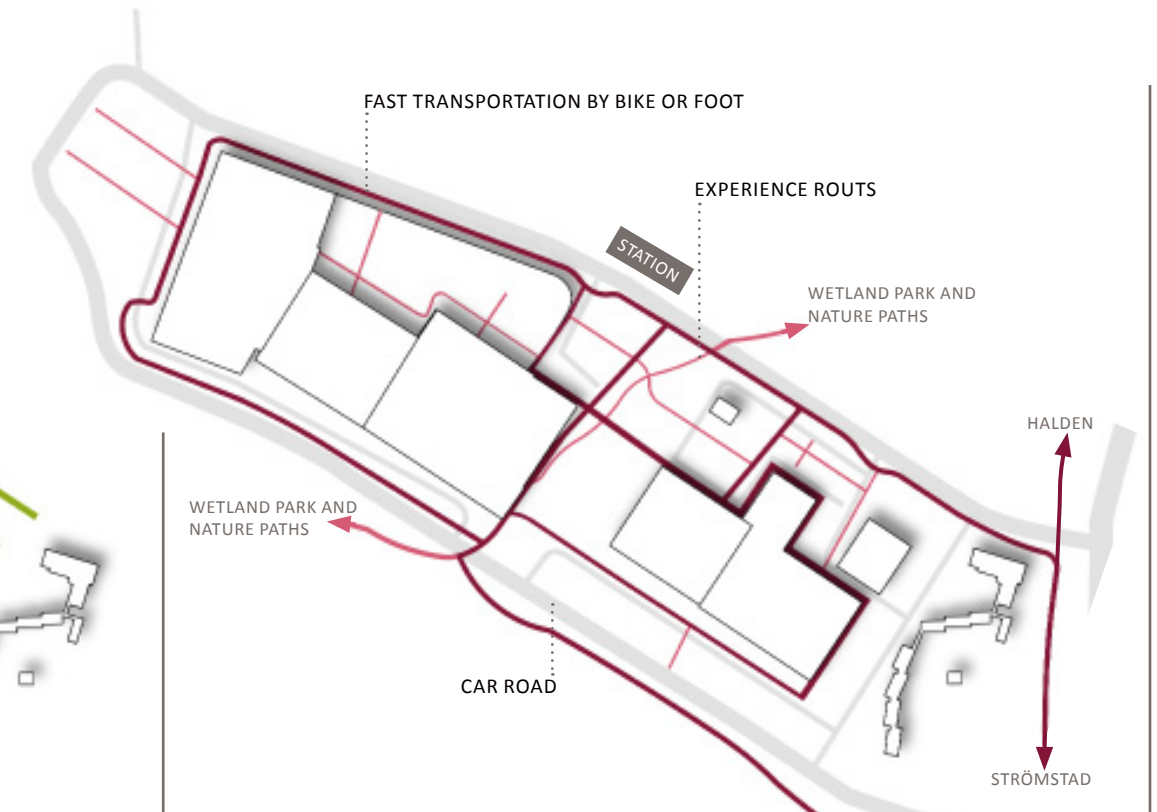
THE CONTINUOUS GREEN STRUCTURE HELPS CLEANING THE WATER, PREVENT FLOODING AND LEAD THE WATER TO THE WETLAND PARK.



KOBUNGSBÄCKEN IS BROUGHT TO THE SURFACE AND USED IN THE DESIGN AS A EXPERIENTIAL FEATURE.



LOCAL PLANT MATERIALS ARE USED, THIS STRENGTHEN THE LOCAL RECOGNITION AND THE AGRICULTURAL STRUCTURE OF THE PLACE.



SEPARATED PATH NETWORK



THE PATHS IS FOLLOWING THE GREEN STRUCTURE AND A CLEAR TRAFFIC SEPARATION IS STRENGTHENING THE ORIENTABILITY AND SAFETY.



THE ORIENTABILITY IS ALSO STRENGTHENED BY THE HIERARCHY IN PATHS WHERE MATERIAL AS WELL AS WIDTH AND STRETCH DIFFERS THEM.

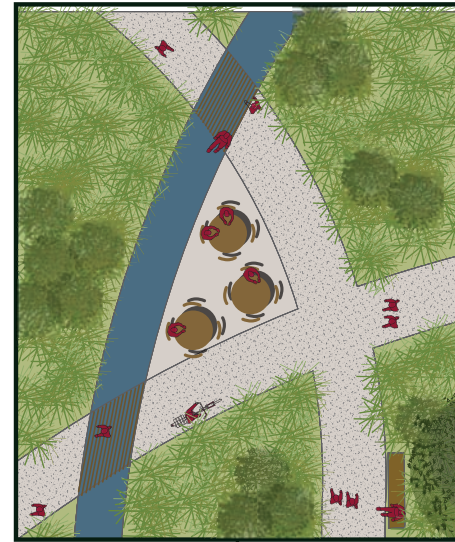
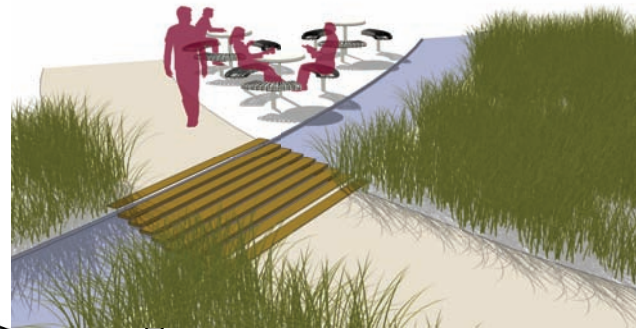


THE MAIN SQUARE OFFERS PLACE FOR DIFFERENT SOCIAL ACTIVITIES AND SOCIAL MEETING PLACES IS PLACED ALONG THE PATHS.

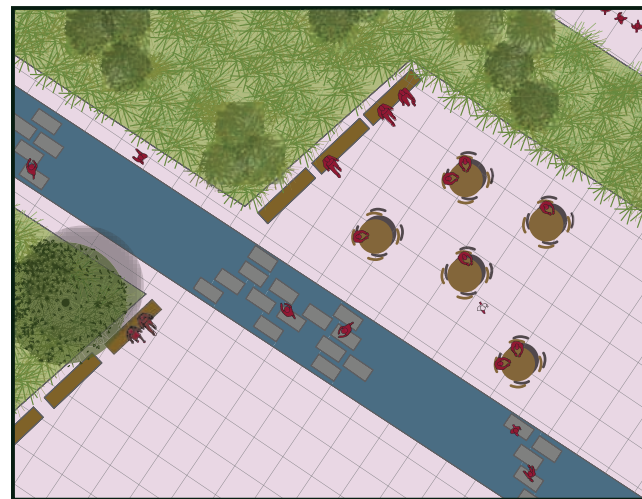
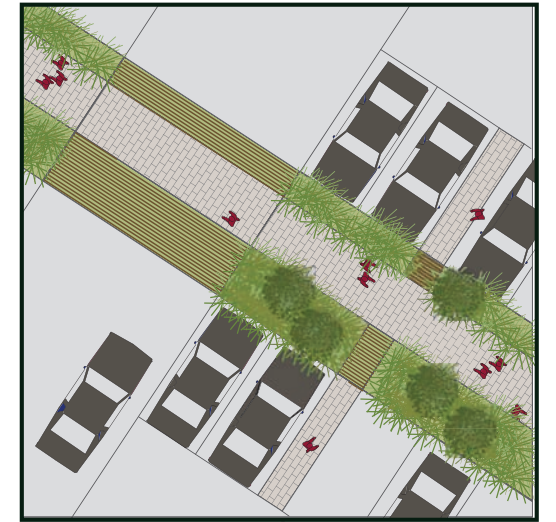


PATHS THROUGH THE GREEN WEDGE GUIDE PEOPLE THROUGH THE MALL AND TO THE NATURE AND THE WET LAND PARK

EXPERIENCE ROUTS THROUGH THE GREEN WEDGE PARK



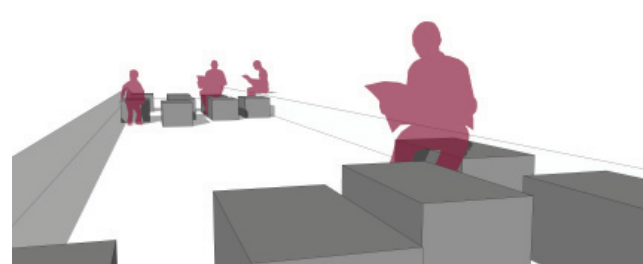
WATER TREATMENT COMBINED WITH GREEN AREAS AND SAFE PATHWAYS



EXPERIENTIAL WATER AT THE MAIN SQUARE

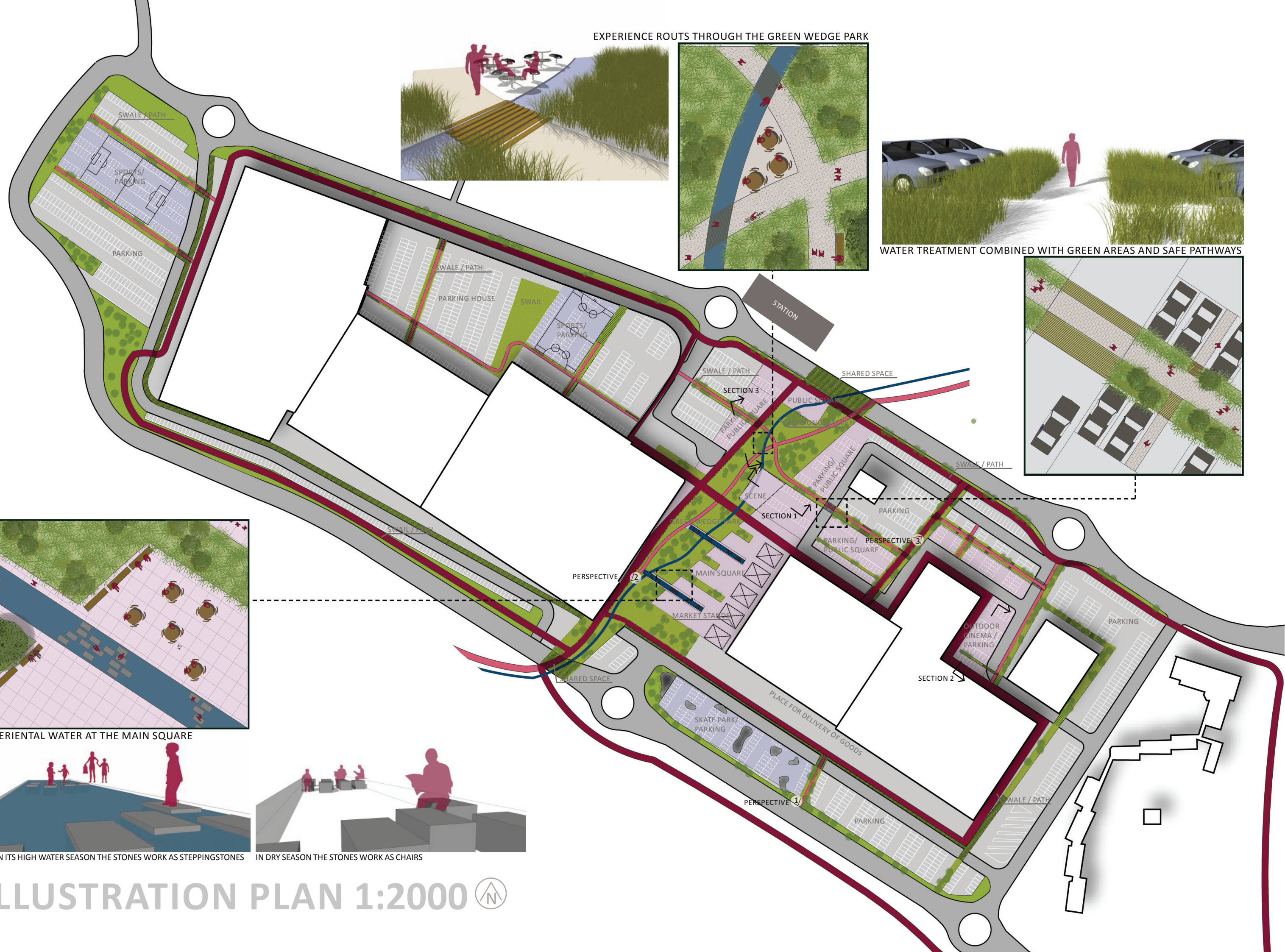


WHEN ITS HIGH WATER SEASON THE STONES WORK AS STEPPINGSTONES

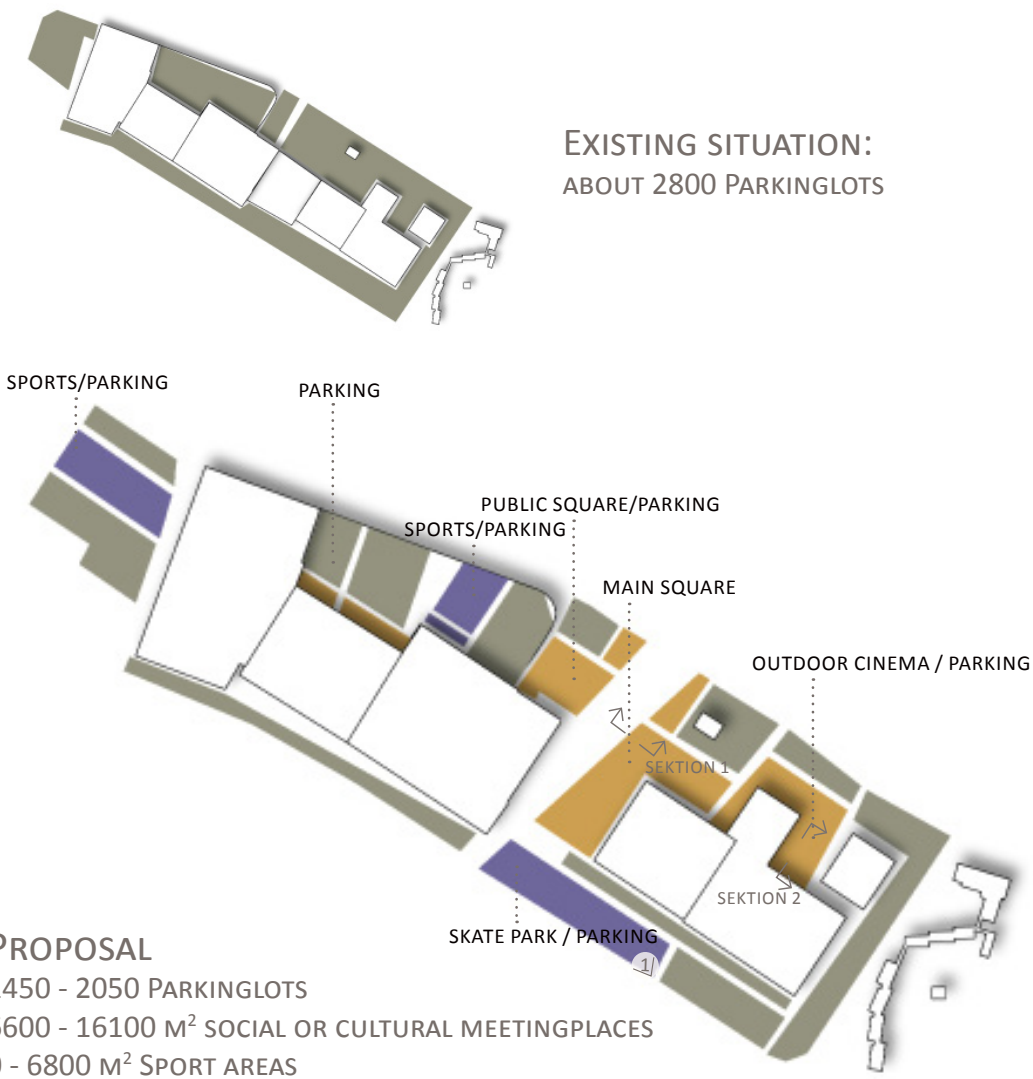


IN DRY SEASON THE STONES WORK AS CHAIRS

ILLUSTRATION PLAN 1:2000



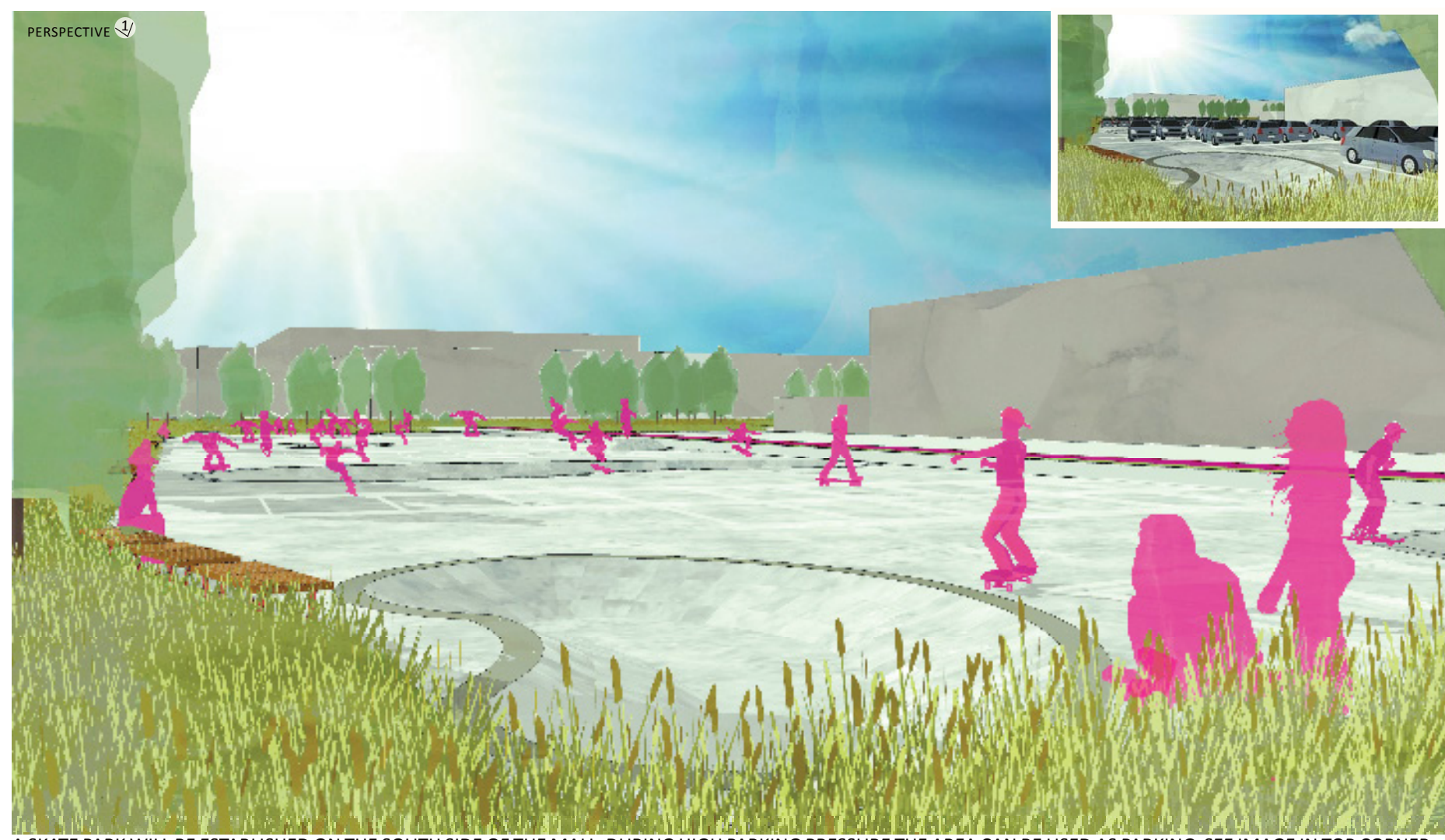
CHANGABLE AREAS



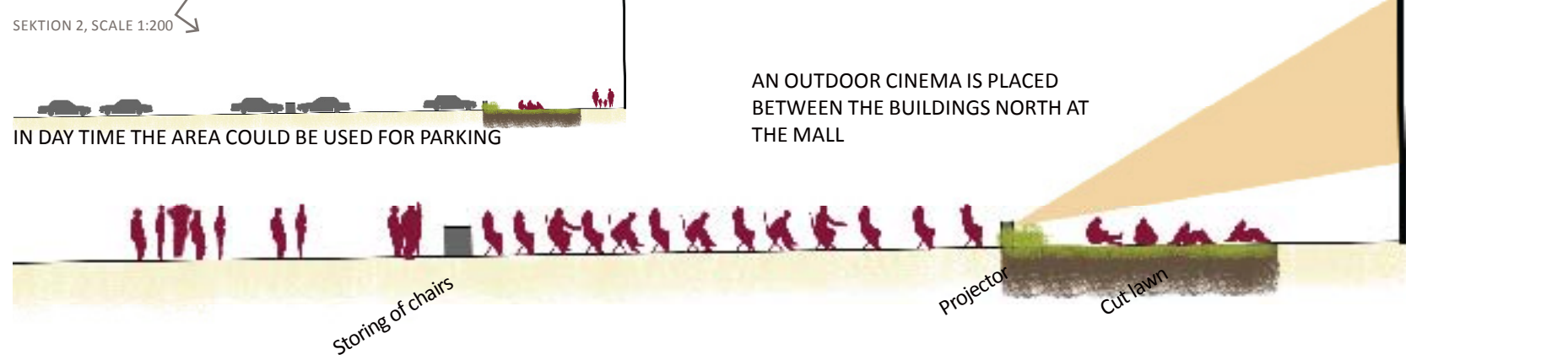
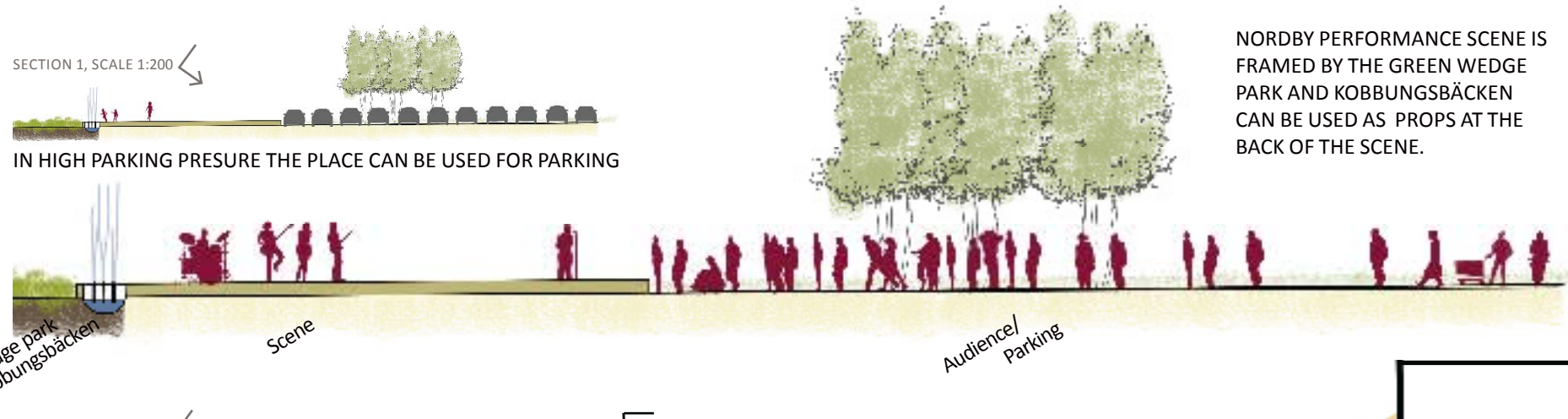
PROPOSAL
 1450 - 2050 PARKINGLOTS
 6600 - 16100 M² SOCIAL OR CULTURAL MEETINGPLACES
 0 - 6800 M² SPORT AREAS



The vast open spaces around the shopping mall are split up and get more functions to increase the opportunities for social interaction. Many of the modified spaces can still be used for parking in high pressure seasons. The hope is that the parking needs will decrease over time with better public transport and walking and cycling paths. As the parking requirement is reduced, the open spaces will start to fill their “social” function more and more until the parking areas with no other function is enough to fill the parking needs. The hard surfaces that only serves as parking area will be built upon in the next step with more small-scale and permeable buildings to take down the scale even further. See more on this in Jannicas proposal on page 117. Parking lots closest to the mall are reserved for people with 4 or more people in the car or people who allows “hitch hikers” where special signs is available where you can write how many car seats you have left, where you are going and which time you are leaving.



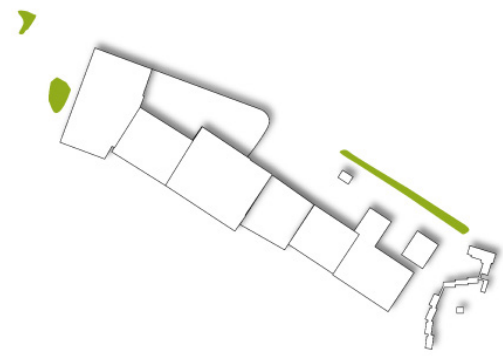
A SKATE PARK WILL BE ESTABLISHED ON THE SOUTH SIDE OF THE MALL. DURING HIGH PARKING PRESSURE THE AREA CAN BE USED AS PARKING, SEE IMAGE IN TOP CORNER



NORDBY PERFORMANCE SCENE IS FRAMED BY THE GREEN WEDGE PARK AND KOBGUNGSBÄCKEN CAN BE USED AS PROPS AT THE BACK OF THE SCENE.

AN OUTDOOR CINEMA IS PLACED BETWEEN THE BUILDINGS NORTH AT THE MALL

CONTINUOUS GREEN STRUCTURE



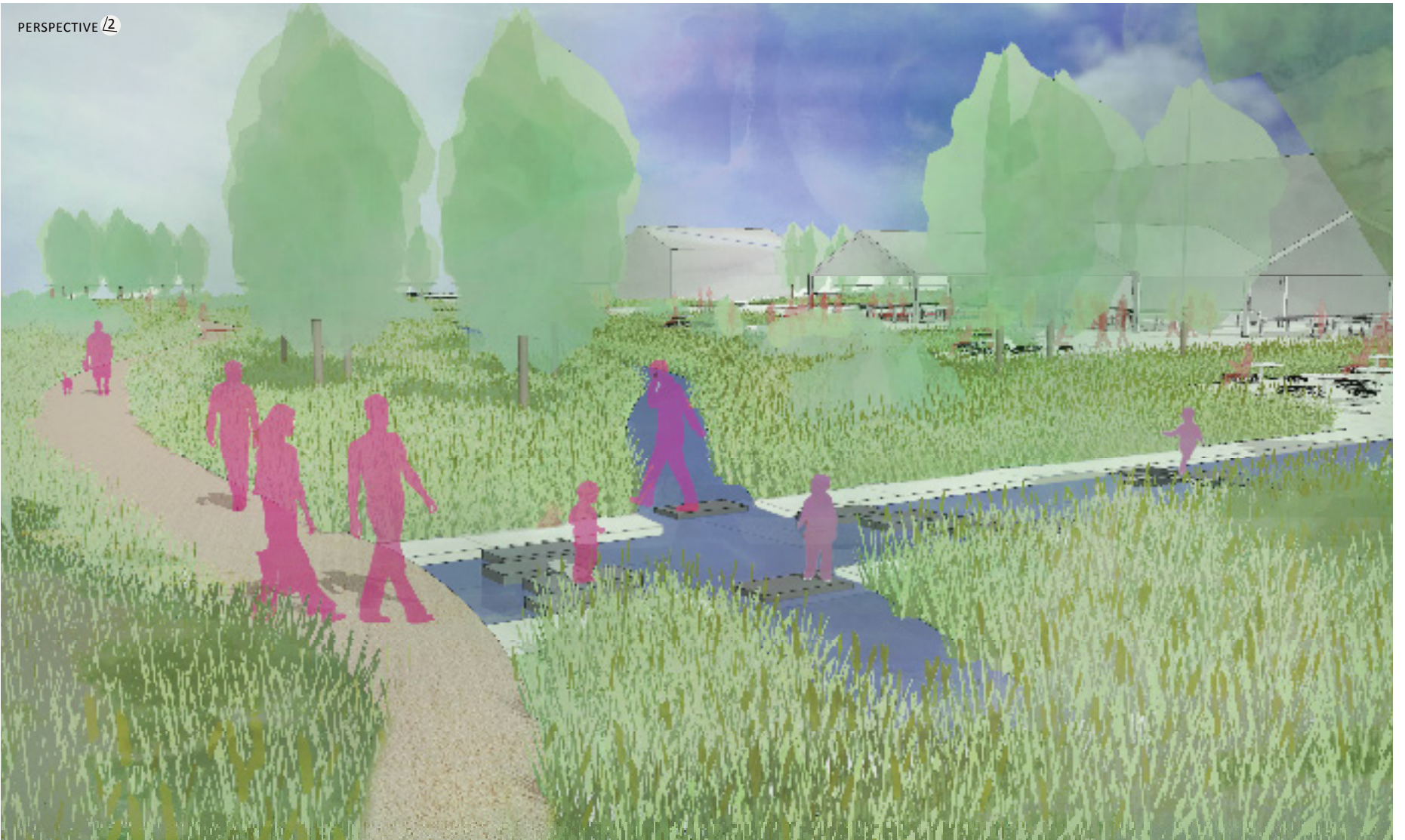
EXISTING SITUATION:
3400 M² GREEN SPACES
2% OF TOTAL AREA



PROPOSAL:
36000M² GREEN SPACES
25% OF TOTAL AREA

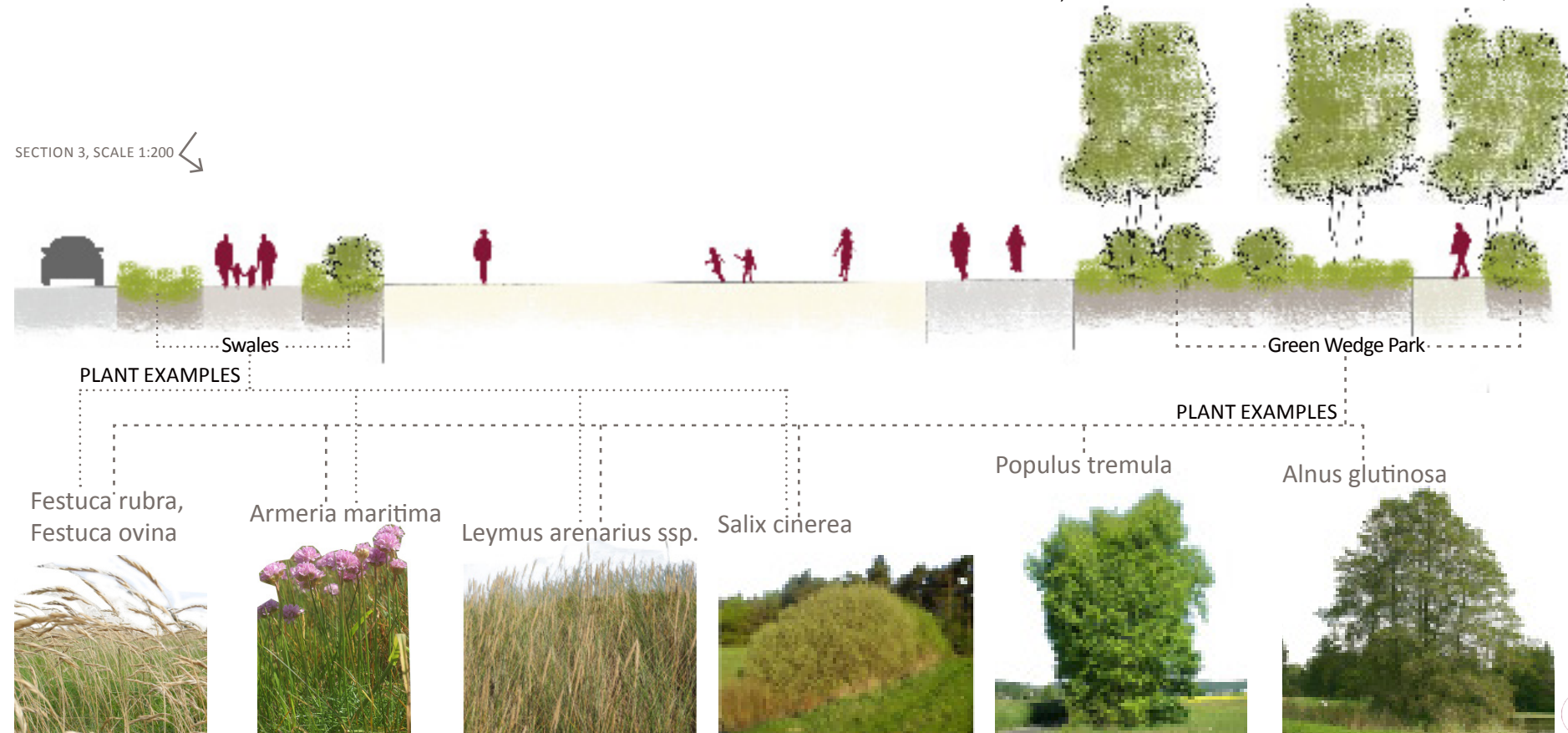


The various open spaces, see previous page, is separated by green wedges like the vegetation that differs agricultural islets from each other. The plant material is local and inspiration is taken from the surrounding agricultural land. The green wedges are joined together in a network that leads the stormwater to Kobbungsbäcken and further on to the wetland park, described in Patricia's part on page 102. The green wedges also serves as Swales and the chosen plant materials that have a purifying effect on the water. The largest green space, the Green Wedge Park, cut through the shopping mall and offers besides a connection of habitat a strong connection to the surrounding natural environment for the people visiting the site. The Green Wedge Park also allows Kobbungsbäcken to flow relatively freely and in the public places water is used as experiential features in the design.

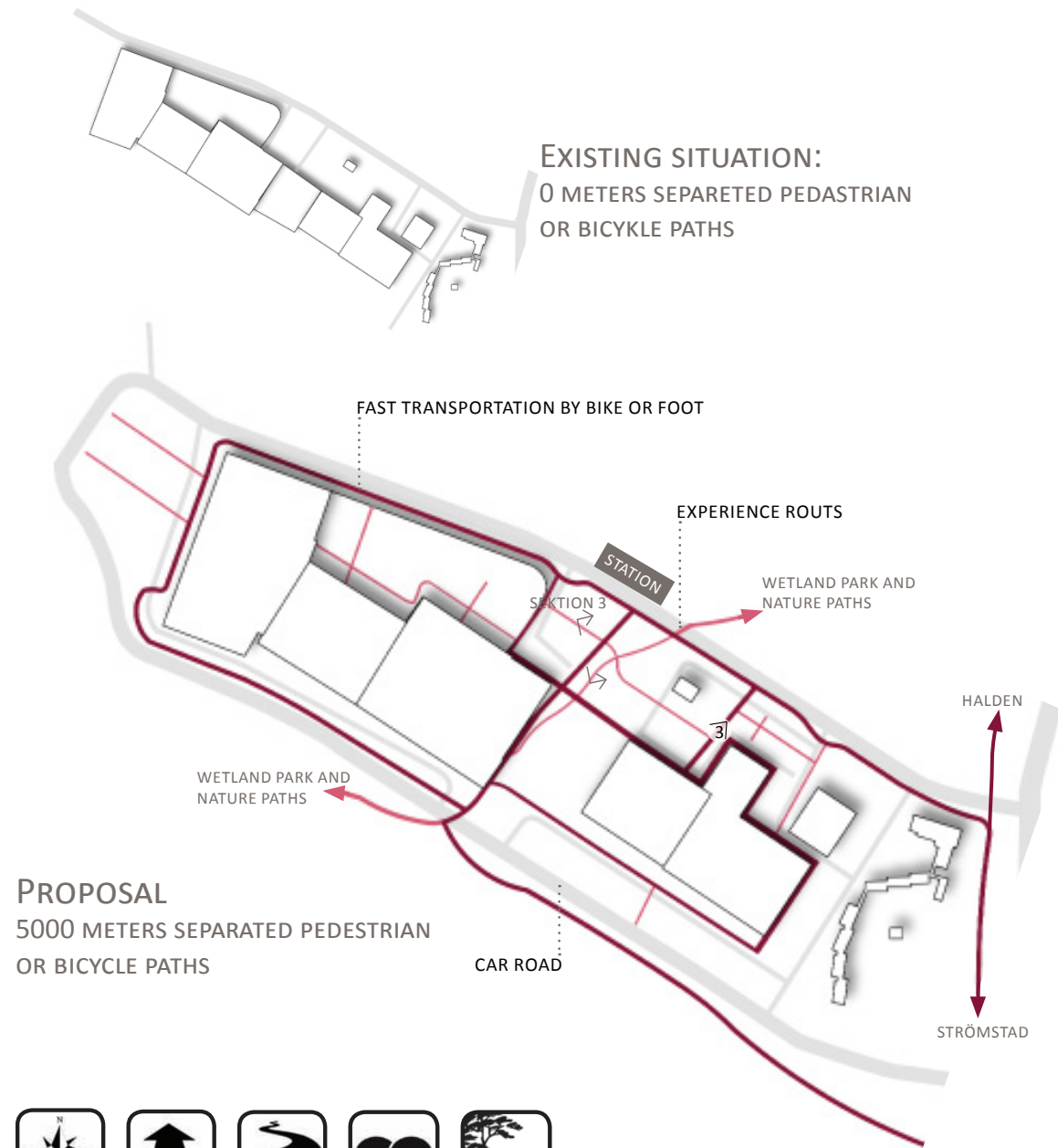


A SMALLER PATH WINDS THROUGH THE GREEN WEDGE PARK WHERE KOBBUGSBÄCKEN IS BROUGHT TO THE SURFACE, HERE CONNECTING THE PARK WITH THE MAIN SQUARE

SECTION 3, SCALE 1:200



SEPARATED PATH NETWORK

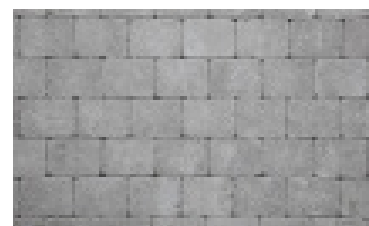


The proposal put much emphasis on walking and cycling routes that are clearly separated from car traffic to ensure safe and easy transport alternatives to the car. From the bus station you have direct contact with the Green Wedge Park and the main square which will be the shopping malls main meeting place for spontaneous as well as planned meetings. From the main square it is easy get around the site and also to enter the nature paths. The main square is also reached via the main routes for cyclists that extends all the way to Strömstad and Halden. Most walking and cycling routes are located along the green wedges and are lined with benches. The green wedges increase the orientability of the site along with the difference in materials and road width.

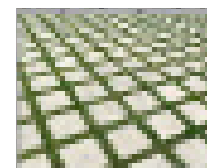


SMALLER PATH THROUGH PARKING AREA
WIDTH: 3 METERS

MATERIAL EXAMPLE



PUBLIC SQUARE
MATERIAL EXAMPLES



MAIN PATH
WIDTH: 5 METERS

MATERIAL EXAMPLE

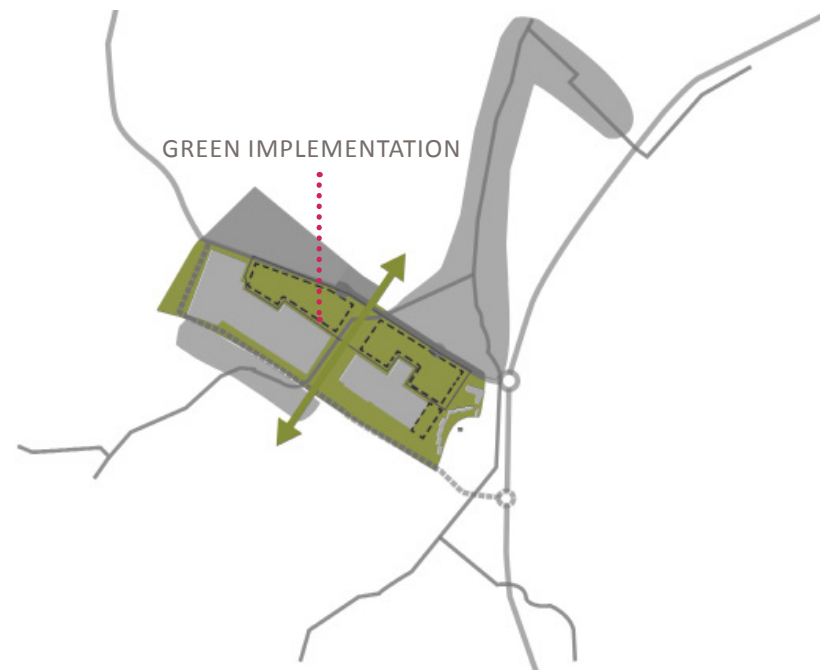


PATH THROUGH GREEN WEDGE PARK
WIDTH: 2 METERS

MATERIAL EXAMPLE



NORDBY - MORE THAN A MALL
JANNICA LINDÉN
SECOND STAGE
YEAR 5-30



NORDBY
MORE THAN A MALL



NORDBY

MORE THAN A MALL

BUILT STRUCTURE



ORIENTATION

Different structures and buildings with identity makes it easier to orientate, with small scale development added to the homogeneous shopping centre it creates new environments inside the area of the mall. From the small scale structure with open facades on top of the existing parking garage to the open space with the green wedge cutting through where more built structure continues creating places in a human scale between the buildings.



LANDMARK

The design of the new structure communicates a varied use where small scale entrepreneurs are encouraged. Another addition is the restaurant barn on top of the bigger mall building, serving as a landmark in the area while also connecting to the cultural landscape and taking advantage of the location on the sunny roof.



CHANGEABLE AREAS

The new development in a smaller size have the advantage of being more adaptable to change because it can host smaller activities or even function as housing in the future. If needed one entrance can use a number of pitches to put up a bigger business.



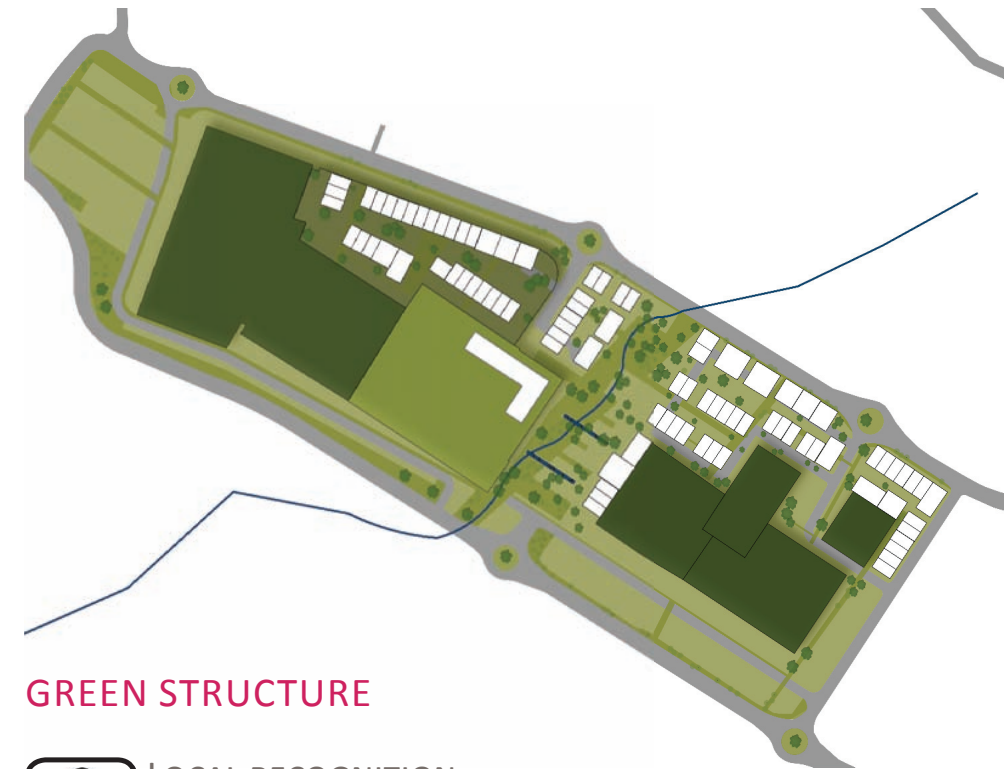
PREPARATION FOR CHANGE

The variety of premises that are created makes the area more prepared for a change of use in the future. My aim is to create a resilient structure that can embrace changes and adapt with time.



SOCIAL MEETING POINT

A more permeable design and lively facades with a lot of entrances should contribute to more spontaneous social interactions in the outdoor environment.



GREEN STRUCTURE



LOCAL RECOGNITION

By creating the park and square, cutting through the shopping mall area as green wedge, we are also creating a sight line that enables people to see the connection to the surrounding agricultural landscape. The design of the barn restaurant should also have a strong local connection to the cultural landscape and be encouraged to serve locally produced commodities.



SOCIAL MEETING POINT

The different green areas, squares and paths in the area provide space for social meetings. By having a variety of places in different scales they can serve different purposes. The large square in the middle can host big events and provide a market place and the smaller squares and paths can provide places for more personal meetings between visitors and people working in the area.



CHANGEABLE AREAS

A square could for example host a market in one day and be used as a parking area the next. Adaptable areas that can be used as they are needed and where the use can change after demand. The green wedge with the square that can be flooded during high water levels is another example of multiple uses in different times.

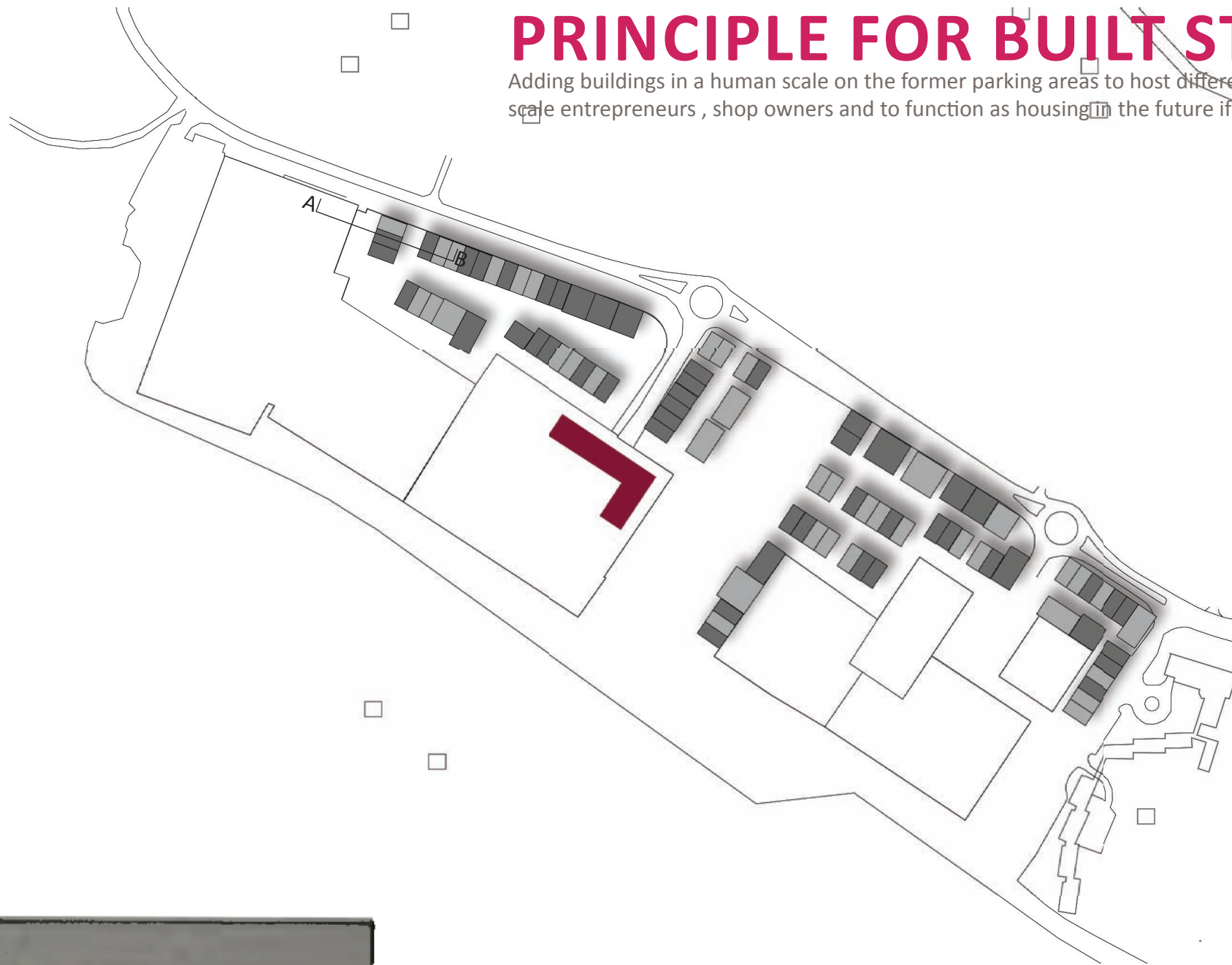


PREPARATION FOR CHANGE

With a higher amount of precipitation expected in this area in the future it is important to provide good conditions to take care of the rain water and prevent pollutants from the paved area to leak out in the environment. Green roofs on the large area of the existing shopping mall buildings connected to green walls and swales is expected to serve this purpose.

PRINCIPLE FOR BUILT STRUCTURE

Adding buildings in a human scale on the former parking areas to host different activities and attract small scale entrepreneurs , shop owners and to function as housing in the future if needed.



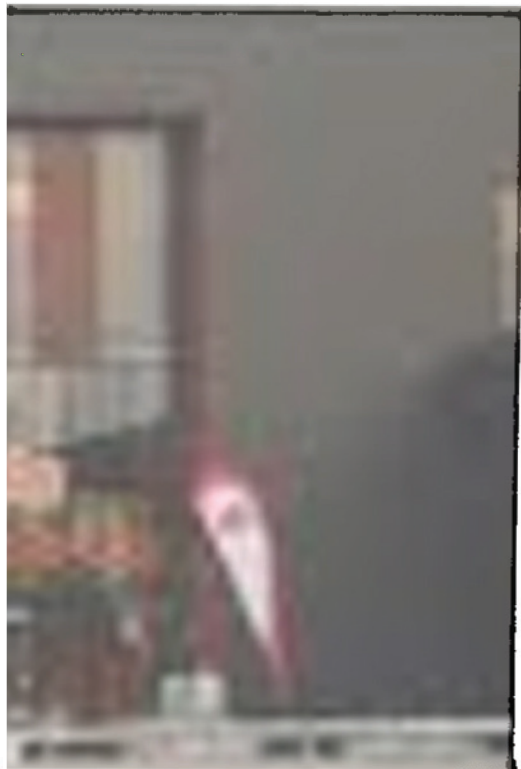
Building added on top of existing large scale building creating an interesting mixture of scales and rooms.



Human scale street structure with small buildings and many entrees to create a more interesting environment for social meetings.

CROSS SECTION

Showing street section and spaces between buildings.

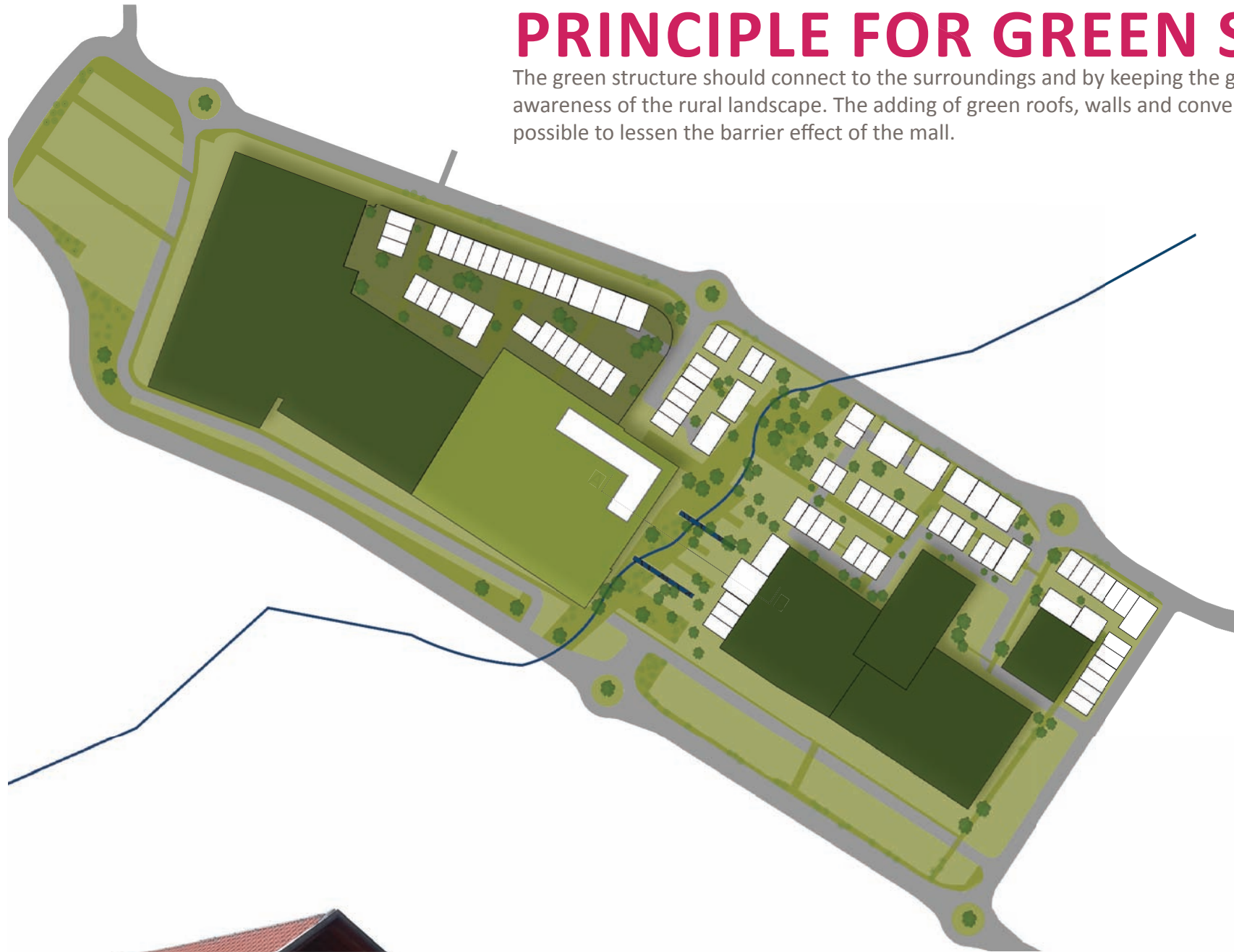


A

B

PRINCIPLE FOR GREEN STRUCTURE

The green structure should connect to the surroundings and by keeping the green wedge and sight line enhance the awareness of the rural landscape. The adding of green roofs, walls and converting as much as the paved areas as possible to lessen the barrier effect of the mall.



Green walls and roofs combined with the other green informational areas around the mall helps preventing floods and also gives the mall a closer connection to nature.



CROSS SECTION

Shows the barn restaurant on top of the existing mall building, the big open square and green wedge that creates the sight line through the area and the added small scale buildings with shops to the open square.



A



B



NORDBY

MORE THAN A MALL

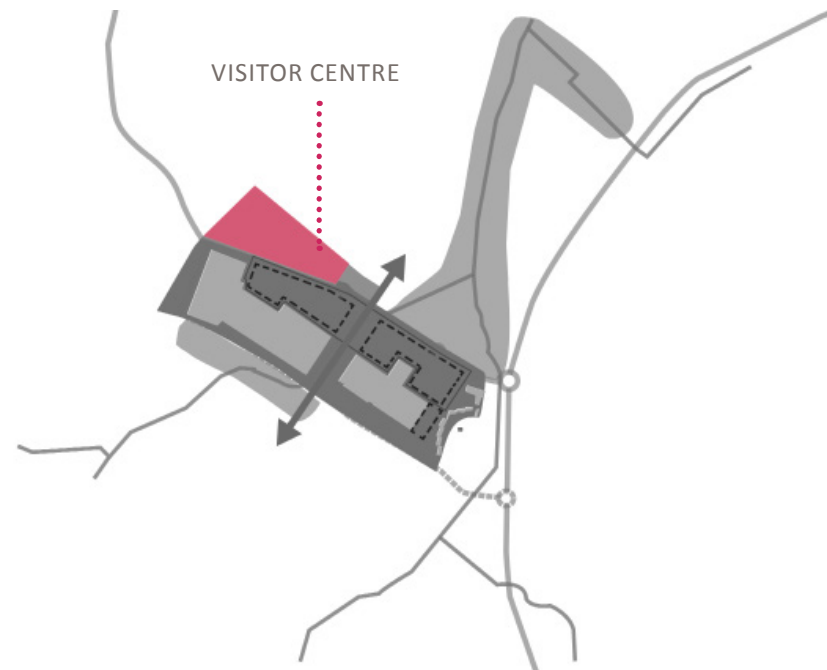
A new structure that can contribute to a more resilient Nordby with a higher diversity in both the built and the green structure. This should make this area more prepared for future changes in both market and environment.

1: 2000

VISITOR CENTRE
MARIA BERGVALL

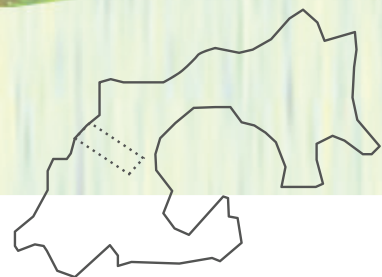
SECOND STAGE

YEAR 5-30



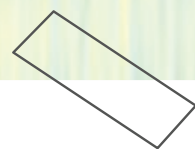
VISITOR CENTRE

FOOD SUPPLY



Arable land at Nordby 4,5 km²
one year food supply for

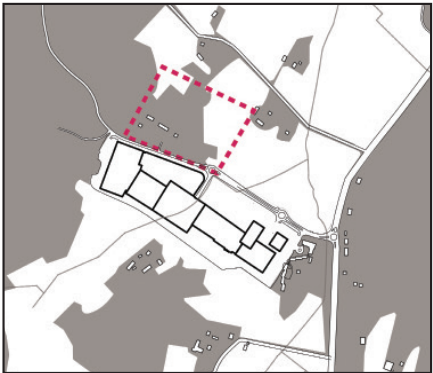
900 people



Area comprise Nordby mall 1,8 km²
one year food supply for

36 people

SITE PLAN



THE VISITOR CENTRE IS A GENERATOR FOR ACTIVITIES being situated in the centre close to ongoing activities in the shopping mall. The visitor centre provides alternative activities with the local nature as the focus. Changes in land use forms a significant part of local history. At the visitor centre the visitors can get an understanding for occuring changes and discuss future land use. The visitor centre is strategically situated next to the transport station, it attracts travelers and provide services.



DEMONSTRATION FARM



LOCAL REGOGNITION
The demonstration farm showcases local historical land use. It is also possible and encouraged for locals to have their own small scale farming projects

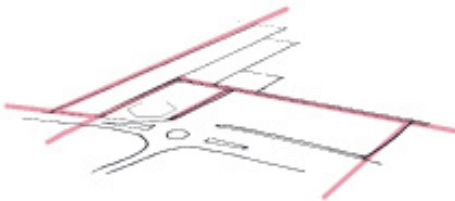


ADAPTABILITY TO CHANGE
By highlighting the issue of future food supply and change in land use the demonstration farm poses questions about how to use the land in a resilient way.



CONNECT HUMAN WITH NATURE
The demonstration garden is based on the thought of education and interaction between humans and nature. It allows visitors to approach the nature and be part of it with a greater understanding.

CONNECTIONS



ORIENTATION
A wide board walk demarcates the important path taking people between different points of interest.

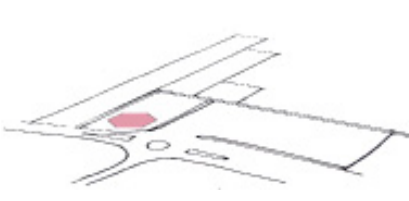


NODE
Placed next to the new transport station, the visitor centre is part of the Nordby hub. The visitor centre facilitates services for transit and non-transit users.



EXPERIENCE ROUTES
Beside the boardwalk there are many smaller paths winding through the farm and the forest. The paths are designed to maximise the experience of the local landscape.

VISITOR CENTRE



LANDMARK
The large open square and the detached centre in the middle are highly visible in the open landscape. Small scale farming strips form a contrast to large scale open landscape and shopping mall.



LOCAL RECOGNITION
The site takes advantage of the area's many innovative local entrepreneurs. Hence providing a platform for local growth as well as showground for eg. exhibitions and markets.

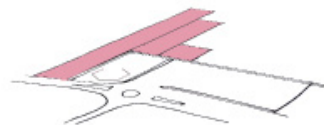


CHANGEABLE AREAS
The open square provides a change of use. Now and in the future the visitor centre can play an important role as a meeting point independent of surrounding changes.



SOCIAL MEETING POINT
The visitor centre is the common denominator for all people visiting or passing through the area. Spontaneous and planned social interactions are accommodated here.

DEMONSTRATION FARM



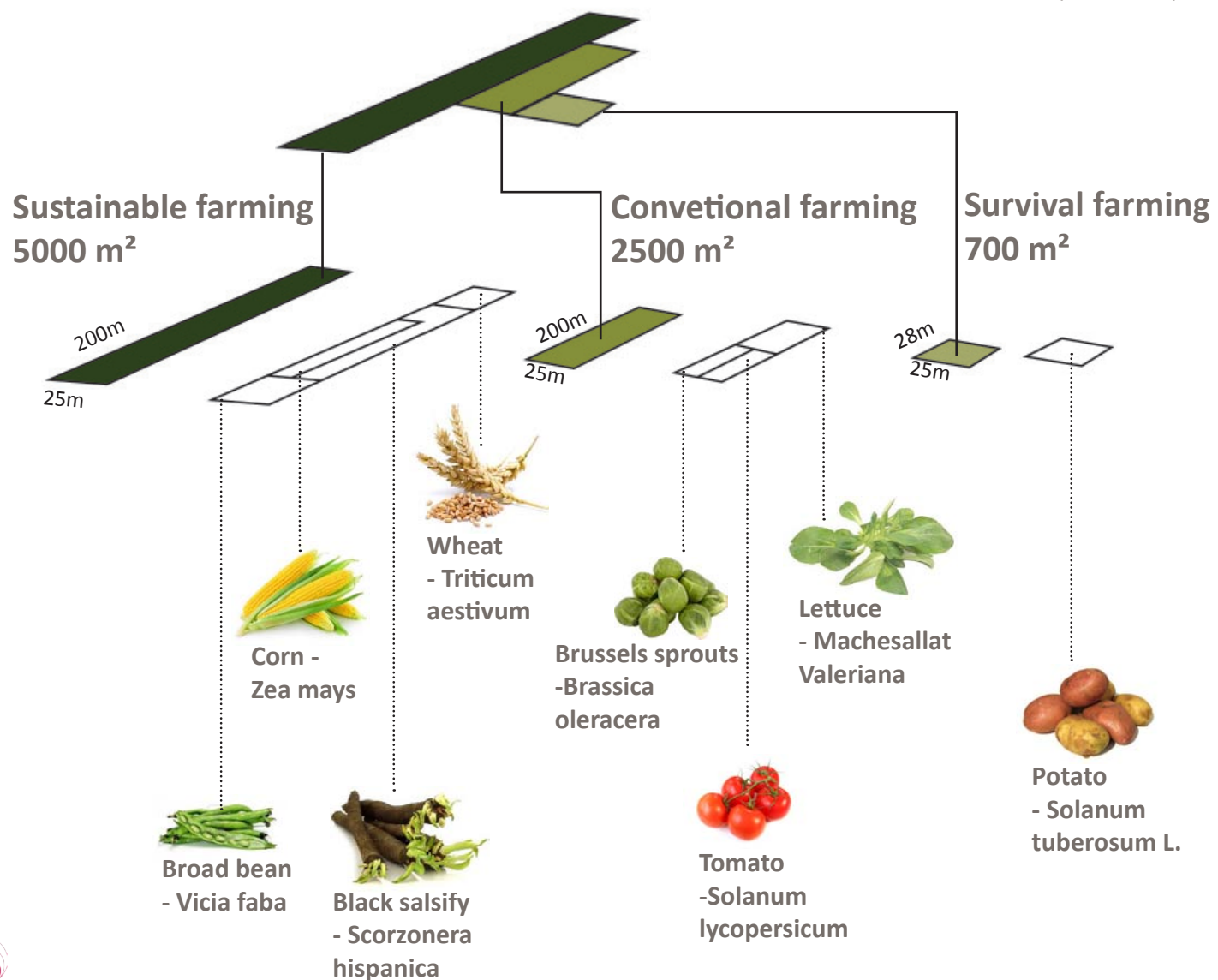
THE DEMONSTRATION FARM IS AN URBAN FARMING MODEL which could be replicated at other sites around the country. With a growing population arable land will increase in value and local small scale farming will be essential in the near future. The purpose of the demonstration farm is to show the agricultural land needed in three types of farming, and also to be a model for increased local small scale food production.

Sustainable farming means a production that allows the land to lie fallow and doesn't drain the soil. When producing food for a diverse diet, including meat, 0.5 hectare is needed per capita.

Conventional farming is currently the largest type of farming and requires 0.2 hectare per capita. That also includes a diverse diet with meat. Conventional farming has a much higher impact on the land resulting in nutrient-deficient soils.

Survival farming uses the absolute minimum land needed for survival per capita. The land required is 0.07 hectare and includes a strict vegetarian diet and farmers that makes no mistakes.

(FAO 1993)



THE DEMONSTRATION FARM IS AN URBAN FARMING MODEL ???

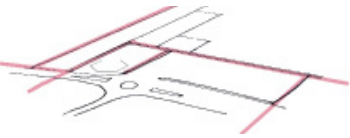
THE LOCAL FARMERS CONTRIBUTE WITH KNOWLEDGE about farming and local traditions. They run the major agriculture outside of the demonstration patches to supply the shopping mall, restaurants and cafes with food.

THE LOCALS SPREAD THE WORD about the new farming model where one can lease a smaller patch of agricultural land to produce food for their families or to sell at the market.

THE CHILDREN OF TOMORROW will be part of a new food supply model based on local production and participation.



CONNECTIONS

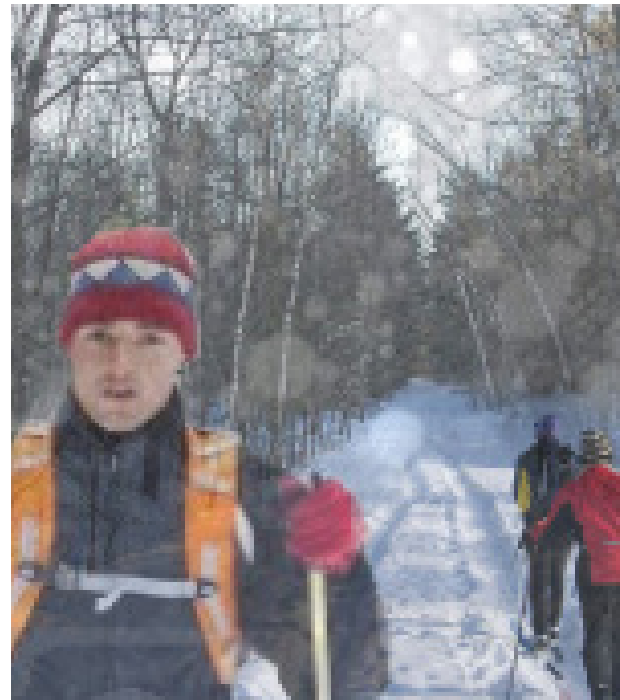
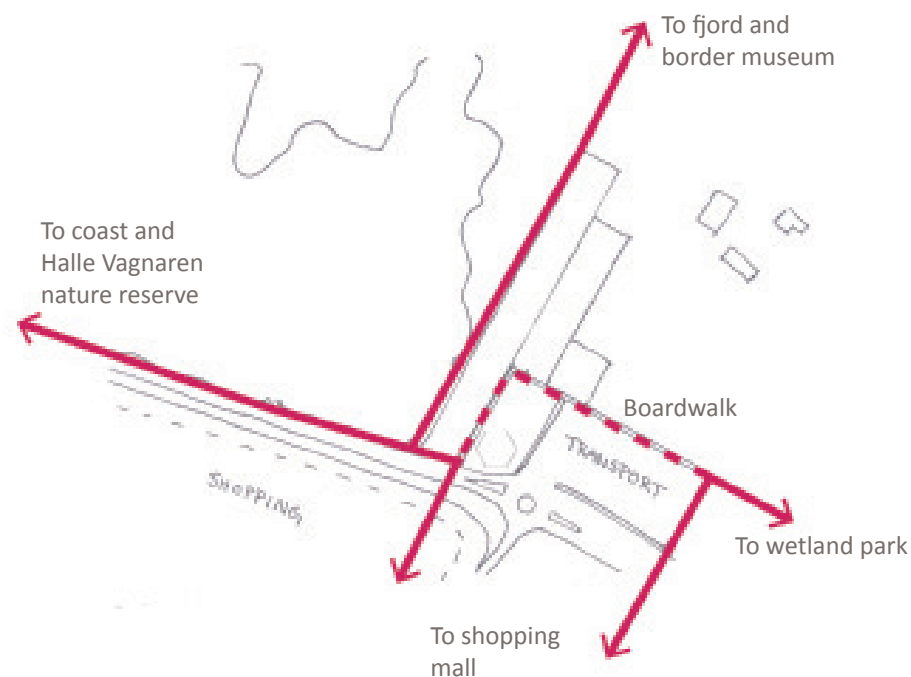


THE CONNCETIONS ARE MANY between the shopping mall, visitor centre, wetland park and surrounding nature. Since we belive Nordby will develop into a flourishing hub the road and path network are essential to provide easy access and to showcase the most important attractions in the area.



MAJOR PATHS

A raised boardwalk follows round the visitor centre providing good views over the demonstration farm and the wetland park. The boardwalk connects to the major paths leading out to attractions in the surrounding landscape. They are wide enough for bicycles.

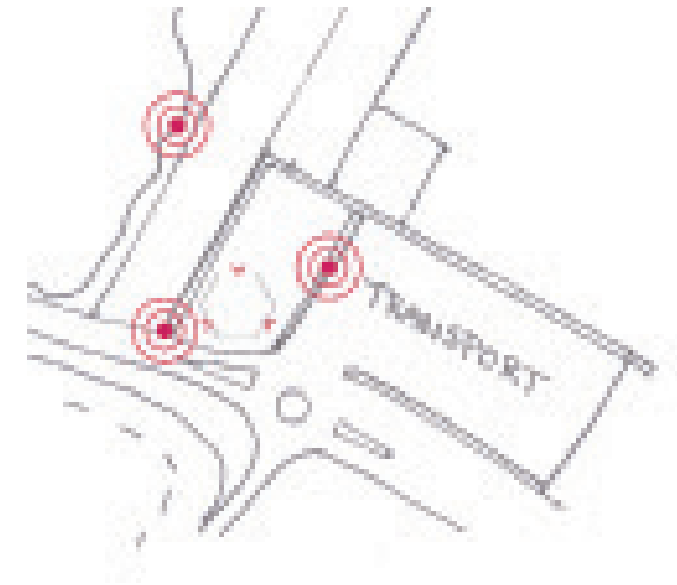


SMALL SCALE PATHS

All trails start at the visitor centre. Some of them are cicular and others connect with pre-existing paths. The small scale path network also provides connections to and usage of the beutiful Norwegian trails.



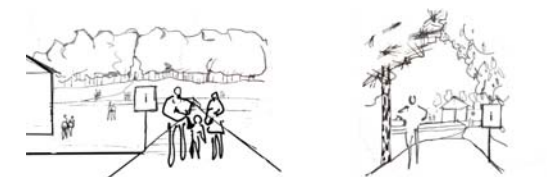
- ▲ **THE FOREST TRAIL**
Into the deep forest and later on out on a plateau looking out over the ldefjord
- ▲ **THE WATER TRAIL**
Takes you to discover the large constructed wetland
- ▲ **THE FARMING TRAIL**
Weaves through the demonstration farm with information stops teaching you about the farming
- ▲ **THE HISTORICAL TRAIL**
Leading out on the open field and over the old E6 displaying many historical remnants
- ▲ **THE CROSS TRAIL**
Bring your bike and be prepared for a beautiful and dramatic terrain along the coast
- ▲ **THE BOULDERING TRAIL**
The rift valley in the south has steep walls perfect for rock climbing and bouldering



ENTRANCES

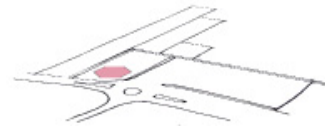
The visitor centre and the square is a flat area melting into the surrounding open agricultural plain. The view is clear with many site lines. You can entre the visitor centre from three directions. The square and the boardwalk is easy to accsess from any direction. Even though this is an open and extrovert area there are three entrance ports; from the forest in the west, from the shopping mall and from the transport station.

ENTRANCE PORTS
Entrance ports showing the transition between areas. Here one can be informed about and have a clear overview of the area.

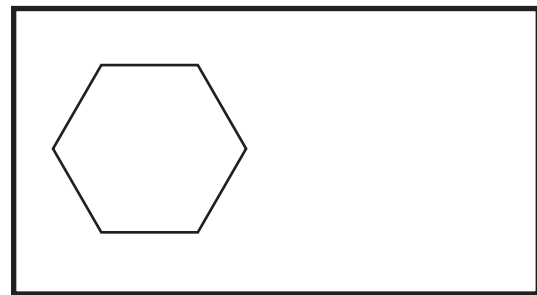


PHYSICAL ENTRANCES
The entrances into the visitor centre are placed to invite as many people as possible from the three major directions.

VISITOR CENTRE



THE VISITOR CENTRE IS A STATIC STRUCTURE WITH CHANGEABLE CONTENT and an adaptable surrounding. No matter how the area and the land use changes over time, the visitor centre is there for information, for encouragement of local recognition and innovative thinking. The building itself is not moveable but the interior can change to fit different interests. The main idea is for the visitor centre to be a point for social interactions between visitors and locals.



SMALLER
MARKET
STANDS



EXHIBITIONS



SPORT FIELD
OR
ICE RINK



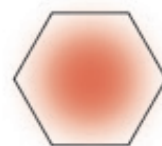
STAGE

PUBLIC SQUARE

An adaptable square that can change appearance and function over short or long term.



WINTER SEASON



- Café
- Exhibitions
- Office
- Meetings

SUMMER SEASON



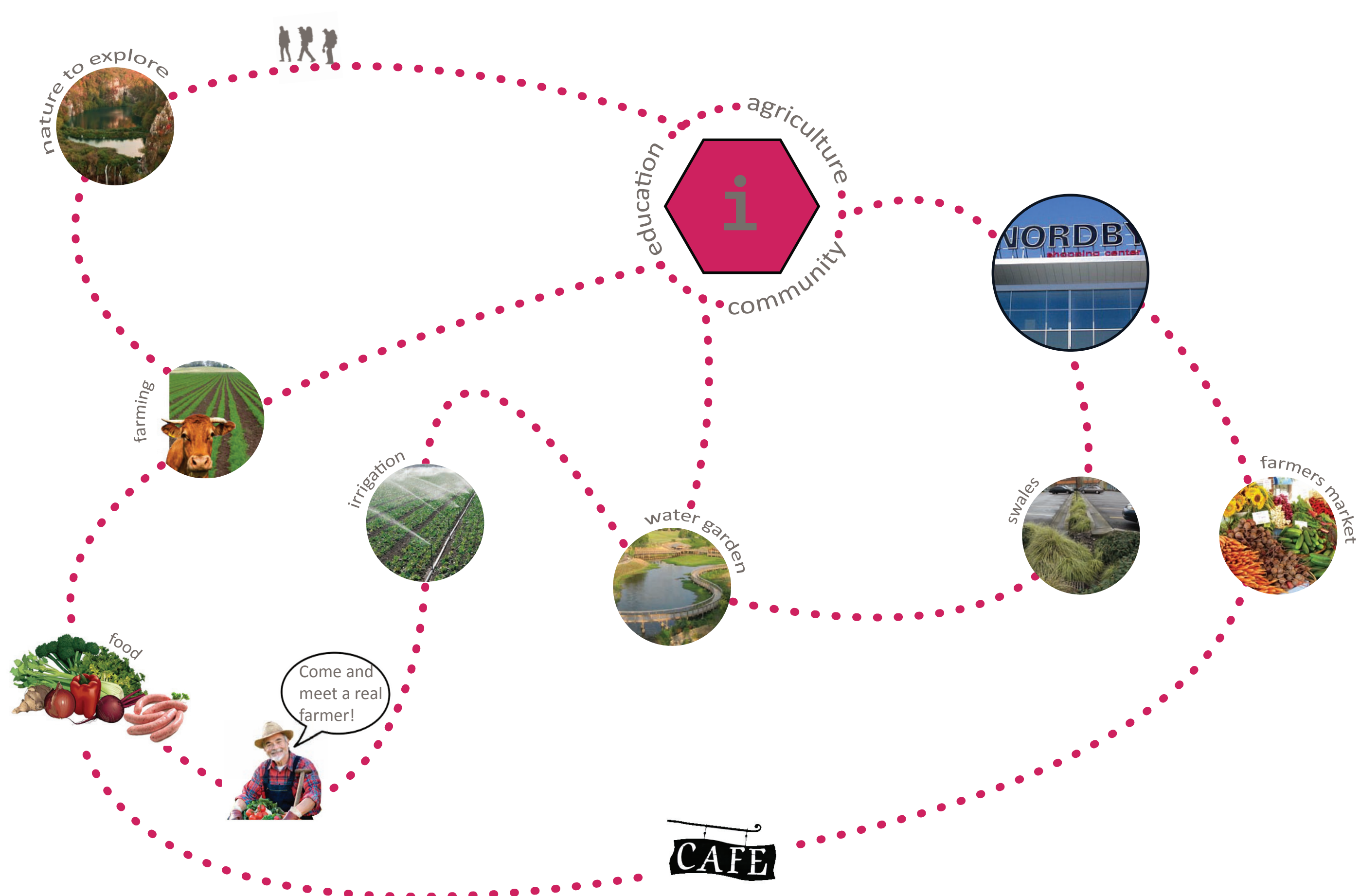
- Information
- Inspiration
- Guidance

VISITOR CENTRE

The building hosts many different functions. It's the main attraction in cold weather but the focus is outwards during summer time.



FUNCTION DIAGRAM



PRECEDENTS

URBAN FARM
SHENZHEN, CHINA



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Salix alba http://commons.wikimedia.org/wiki/File:Salix_alba_'Tristis'_02_by_Line1.jpg	wbd http://www.worldbuildingsdirectory.com/project.cfm?id=3928	Boverket http://www.boverket.se/Global/Webbokhandel/Dokument/2012/Vision-for-Sverige-2025.pdf Wetland park proposal Maps are based on data from Lantmäteriet, available at www.lantmateriet.se
Salix fragilis http://www.lightscapes.info/onewithnature/natures-garden/trees/crack-willow-salix-fragilis/	Web cam Nordby	

MAPS

ASPECT MAPS, FIRST SCALE

Geology and Soil

SGU (Sveriges Geologiska Undersökning): <http://www.sgu.se/sgu/sv/produkter-tjanster/kartvisare/index.html>

Land use

Corine Land Cover by the EUROPEAN ENVIRONMENTAL AGENCY: <http://www.eea.europa.eu/data-and-maps>

Nature Values

The map is based on Skogsstyrelsens interactive map Skogens parlor, available at <http://minasidor.skogsstyrelsen.se/skogensparlor/> [2013-11-01]

Culture and history

Based on Strömstad, Uddevalla and Tanums masterplans (Översiktsplaner)

- Strömstads ÖP available at <http://www.stromstad.se/omkommunen/forvaltningar/kommunledning/oversiktligplanering/oversiktsplan2002.238.html>
- Uddevalla ÖP available at <http://www.uddevalla.se/byggbomiljo/detaljochoversiktsplan/oversiktsplankommunen.4.1ced821ff9985787280007024.html>
- Tanum ÖP available at <http://tanum.se/huvudmeny/boendemiljoinfrastruktur/kommunensplanarbete/oversiktsplan/oversiktsplan2002.4.7664b4813898b7df98453b6.html>

Market

The map is based on our site visits and meetings with Uddevalla-, Tanum- and Strömstad municipalities in September 2013.

ASPECT MAPS, SECOND SCALE

Nature: Areas covered by protections

Based on Strömstad municipality in depth masterplan for Hogdalsnäset. available at: <http://www.stromstad.se/omkommunen/forvaltningar/kommunledning/oversiktligplanering/oversiktsplan2002.238.html>

Nature: High nature values

Based on Strömstad municipality in depth masterplan for Hogdalsnäset available at: <http://www.stromstad.se/omkommunen/forvaltningar/kommunledning/oversiktligplanering/oversiktsplan2002.238.html> and on Skogsstyrelsens interactive map Skogens pärlor, available at: <http://minasidor.skogsstyrelsen.se/skogensparlor/> [2013-11-01]

Nature: Water bodies

Nature: Water bodies

Based on Strömstad municipality in depth masterplan for Hogdalsnäset available at: <http://www.stromstad.se/omkommunen/forvaltningar/kommunledning/oversiktligplanering/oversiktsplan2002.238.html> and on Länsstyrelsens Terrängkartan.

Areas with high culture values page: XX

Based on Strömstad municipality in depth masterplan for Hogdalsnäset. available at: <http://www.stromstad.se/omkommunen/forvaltningar/kommunledning/oversiktligplanering/oversiktsplan2002.238.html>

Historical remnants page: XX

Based on Strömstad municipalities in depth masterplan for Hogdalsnäset and on Skogsstyrelsen interactive map “Skogens pärlor”

- Skogsstyrelsens interactive map Skogens pärlor is available at: <http://minasidor.skogsstyrelsen.se/skogensparlor/> [2013-11-01]
- Strömstads ÖP available at: <http://www.stromstad.se/omkommunen/forvaltningar/kommunledning/oversiktligplanering/oversiktsplan2002.238.html>

MAPS, THIRD SCALE

Wetland park proposal

Own preparation based on data from Lantmäteriet, available at: www.lantmateriet.se